



**A Case Study on Ubiquitous Social Networking:
Fusion Mobile**

Kristine Visanen

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University of Art and Design, Helsinki
Supervisors: Sanna Marttila & Kati Hyyppä

Abstract

ABSTRACT

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Abstract

This thesis deals with the challenges and opportunities inherent in building a prototype capable of supporting ubiquitous social networking applications on mobile devices. The challenges in the design of mobile applications are investigated through a case study that develops a prototype, Fusion Mobile, which is an application for mobile social networking and media sharing. This research is carried out within the context of an ongoing research project, P2P-FUSION, which addresses current difficulties in regards to legal, creative reuse of audiovisual media on the Internet. The project develops a software system called Fusion, which allows anyone to publish audiovisual content only to the audience they want within a P2P network, as well as through a mobile application. In developing this prototype application (Fusion Mobile), and the user interface in particular, I investigate the design process to find general keys to success in social networking application development for mobile devices. I develop a design framework and use a co-design approach to guide the process. By analyzing the design process, I provide insight to mobile application developers regarding the pros and cons of: 1) using a pre-defined design framework to guide application development and 2) involving users and external mobile developers in the design process as co-design partners.

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1 Introduction to the Phenomenon of Ubiquitous Social Networking

By now, most of us have heard of popular, computer-mediated social networking sites (referred to in this thesis as social networking) such as Facebook (www.facebook.com) or MySpace (www.myspace.com). For those unfamiliar with these services, they are websites that provide social networking tools (e.g. link sharing, email, photo sharing, games, etc.) that allow a user to stay in close contact with their “friends” (e.g. members of their personal social network) by sharing items considered relevant, fun, or interesting.

Of course, social networking has been around in one definition or another for many years prior to Facebook. However, if one takes the following specific definition of a social networking site as a place where one can “...1) construct a public or semi-public profile within a bounded system, 2) articulate a list of other users with whom they share a connection, and 3) view and traverse their list of connections and those made by others within the system...”, then the earliest iteration appears in 1997, with mainstream acceptance appearing from 2003 onward. (Boyd and Ellison 2007, p.11)

Further, Dr. Cheryl L. Coyle and Dr. Heather Vaughn define the difference between a social network and social networking as:

“...a social network is a configuration of people connected to one and other through interpersonal means, such as friendship, common interests, or ideas. Social networking, as the phrase is being used in industry and in pop culture today, refers to the use of a specific type of Web site focused on the creation and growth of online social networks which allows users to interact....” (Coyle and Vaughn 2008, p. 1)

While it is too early to say whether or not social networking will be as popular in the future as it is today, it is accurate to state that social networking sites have had a large cultural impact on Internet users in the past few years.

1.1 The Influence of Social Networking on Ubiquitous Computing

While social networking is partially about letting people know what you are doing throughout the day (in addition to sharing files, pictures, and videos), it would be an oversight to underestimate the effect that ubiquitous computing has, and will have, on future social networking applications.

In 1988, Mark Weiser, Chief Scientist in the Computer Science Lab at Xerox's PARC Center, coined the term "ubiquitous computing". Widely considered to be the father of the term, Weiser's definition refers to the "invisible computers in everyday objects". Weiser stated that:

"Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user."

Weiser's vision of ubiquitous computing included the idea that:

"...ubiquitous computers will help overcome the problem of information overload. There is more information available at our fingertips during a walk in the woods than in any computer system, yet people find a walk among trees relaxing and computers frustrating. Machines that fit the human environment instead of forcing humans to enter theirs will make using a computer as refreshing as taking a walk in the woods..." (Weiser 1999, p.3-11)

This concept of ubiquitous computing (or, of computers being "everywhere") has recently been developed further by author Adam Greenfield. Greenfield has expanded upon the concept of ubiquitous computing and calls it: *everyware*. In his book of the same name, Greenfield defines *everyware* as: "...a coherent paradigm of interaction via ubiquitous information technology that includes: ubiquitous computing, pervasive computing, physical computing, and tangible media..." (Greenfield 2006, p.1)

In recent years, the concept of *everyware* has become a relevant force within mobile social networking as well. Users of sites such as Facebook and Twitter can update their status messages via mobile devices and let their friends know exactly what they are up to throughout the day. In fact, Greenfield sees *everyware* as enhancing social networking in a variety of ways since:

"...Current social networking applications...already offer us digital profiles of the people we know. An ambient version... could interpose these profiles in real time, augmenting the first glimpse of an acquaintance with an overlay of their name, a list of the friends we have in common, and an indication of how warmly we regard them..." (Greenfield 2006, p.124)

And while online status updating is not a new concept, the idea that many people now carry

devices with them to read and update status reports is. It is not so much the technology that has changed, per se, but the amount of people using and accessing it in their everyday lives.

As Charlene Li, former Principal Research Analyst (Devices, Media, & Marketing) and Josh Bernoff, Vice President, Principal Analyst, at Forrester Research wrote in their book *Groundswell: Winning in a World Transformed by Social Technologies*:

“... Software that connects people can now assume that masses of people are there to connect. These ubiquitous connections have led to a fundamentally different kind of software. It’s far more interactive because the software can depend on having a powerful machine with a fast connection at the other end. And it’s people-aware—with people connecting all the time, applications like Facebook or MSN Messenger can connect people directly with each other. It’s the technology in the hands of almost-always connected people that makes it so powerful...” (Li and Bernoff 2008, p.15)

Furthermore, as Li sees it:

“...in the future, social networks will be like air. They will be anywhere and everywhere we need and want them to be... without that social context in our connected lives, we won’t really feel like we are truly living and alive, just as without sufficient air, we won’t really be able to breathe deeply...” (Li 2008)

Of course, it is not impossible for us to live without these mobile ubiquitous social networking technologies. However, by proper use and application, it is possible that our lives could be greatly enhanced by them. Just as it is possible to watch a movie on a portable, black and white television with a coat hanger antenna, it is probable that the experience of watching a movie will be greatly enhanced by watching it on a large, flat-screen, color television with surround sound.

1.2 Origin & Motivation of this Thesis

The origins for a thesis about mobile ubiquitous social networking first came to me at one of our development workshops for the Arki Research Group. I had been working as a research assistant at Arki since May 2008. In July, we had staff meeting on the island of Suomenlinna as a part of series of professional development workshops. The goal was to present our ideas to the rest of the group and to discuss how we could further them and reach our research goals. I had become interested in the ideas of design anthropology and mobile ecologies and wanted to research how

mobile devices can offer support in areas such as ubiquitous social networking. Of course, like many new research topics, my original idea was far too broad in scope. I had drawn a mindmap (Figure 1) that showed the five or so different nodes I was interested in.

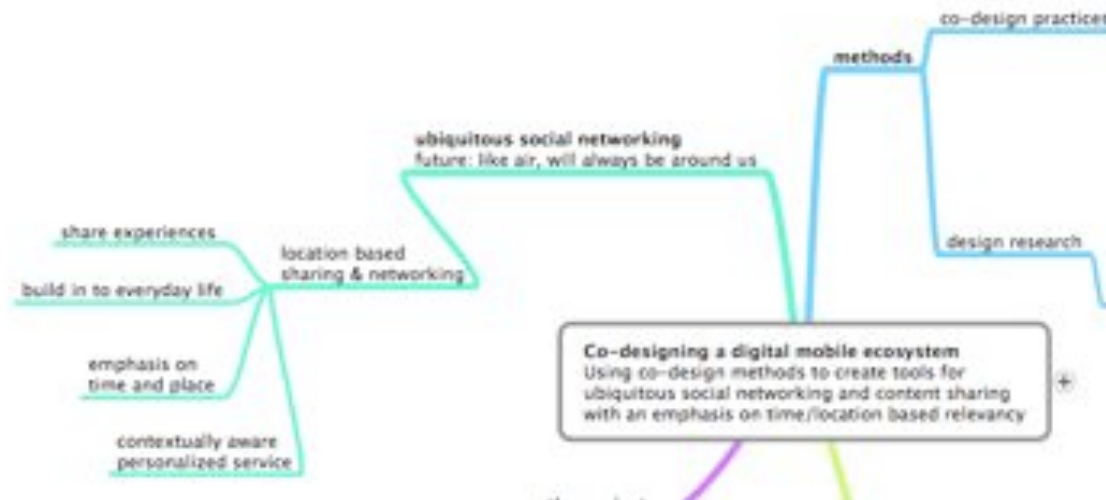


Figure 1 The Original Mind Map

Over the course of the summer, I worked on developing the topic of how mobile devices can support ubiquitous social networking. In order to make my ideas more concrete, I developed a proposal about how this new research could support the existing research work I had been doing for the Arki Research Group on the P2P-FUSION project (<http://p2p-fusion.org>) introduced in more detail in the following chapter. The P2P-FUSION Project, an EU funded project, addresses current difficulties in regards to legal, creative reuse of audiovisual media on the Internet. It aims to create an open, accessible, and legal software environment for creative audiovisual media that can be standalone, or based upon the work of others (including materials from cultural institutions), through built-in, easy-to-use support for suitable licensing schemes (see Appendix 6.1 for screenshots of the desktop software). For example, using the Fusion software, a community of sport enthusiasts could share photos and videos, and enrich them socially via commenting. My main motivation was to deepen my understanding of mobile software design and social networking and to understand ways in which ubiquitous social networking enhances people's lives. Since, the description of work for the P2P-FUSION project I had already been working on included a scenario for mobile devices (see Appendix 6.7.1), this concept fit into the scope of the P2P-FUSION project and was accepted as a thesis topic. The visualization below (Figure 2) shows a conceptual set-up of P2P-FUSION.

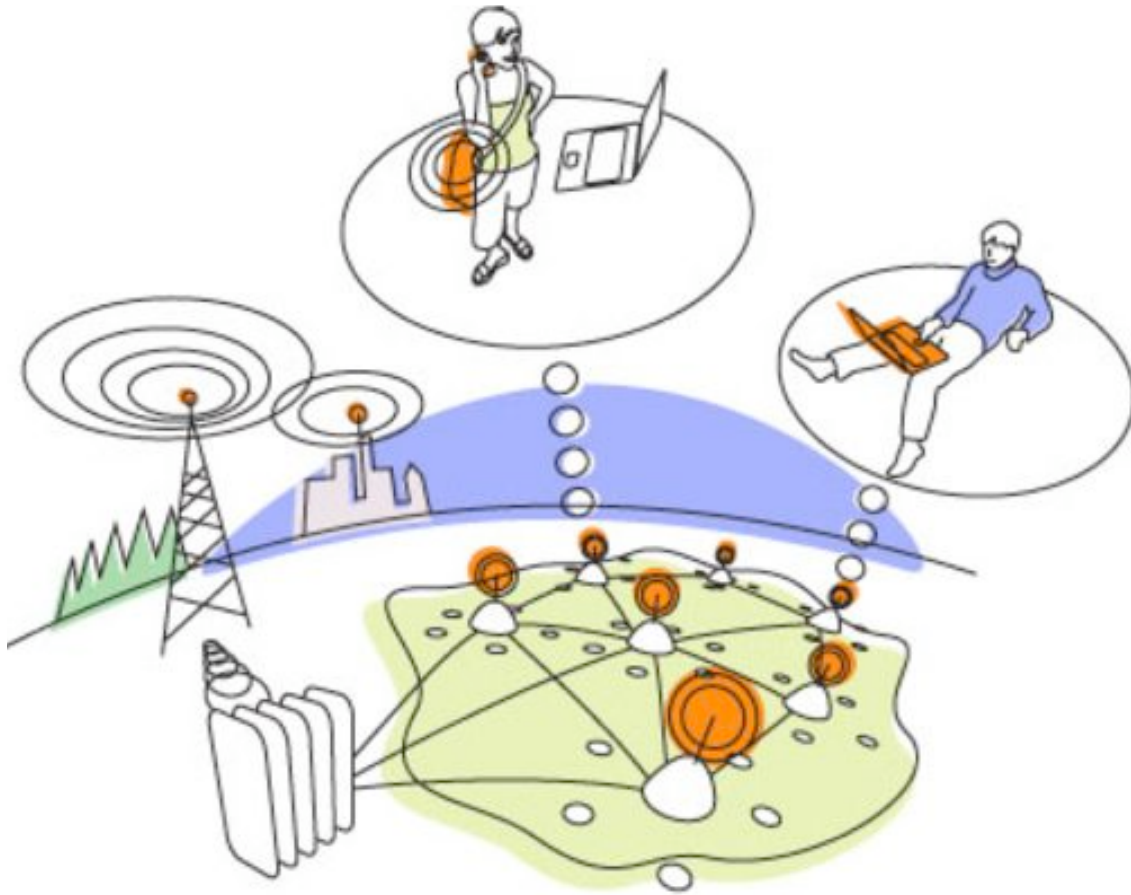


Figure 2 Visualization of P2P-FUSION with desktop and mobile devices. Illustration: Matti Arvilommi.

1.3 Research Approach

After streamlining my notes, I decided to develop a dual-pronged approach to my thesis. I hope that by using this type of approach, I can highlight the duality that is often needed when designing mobile applications. I first read about this concept of duality when reading about Jesper Kjeldskov and Steve Howard's "TramMate" project for the The University of Melbourne. TramMate used both a technology and user-centered design approach to study: "... the use of public transportation by means of a context-aware mobile calendar application..." (Murphy, Kjeldskov, Howard, Shanks, and Hartnell-Young 2004 p.180-190).

The results of the TramMate study were that both a user and technological approach are appropriate to use in conjunction when designing mobile applications. Matt Jones (interaction designer and editor of a journal in the field) and Gary Marsden (Associate Professor of Computer Science at the University of Cape Town, South Africa) paraphrased the results of the TramMate study as:

“...the user centered approach was seen as very useful in producing prototypes that accommodate current practice...[and] envisioning some more radical concept...the technology centered strategy identified some technical constraints that would have to be addressed...” (Jones and Marsden 2006, p.89)

And therefore:

“Designers should combine technology with user-centered design methods in their attempts to envision future mobile services.” (Jones and Marsden 2006, p.89)

While the approach of this thesis is not quite the same that Kjeldskov and Howard used, it is similar in that one research objective informs the other and vice versa. The difference here is that this thesis focuses more on the approach that a user becomes a design “partner” or co-designer, rather than just a “user”. The approach I will take will also focus on using an iterative software design process, where I, as a user interface designer, work in close collaboration with a software application developer and communities interested in using the software.

1.4 Research Objectives

Therefore, the general research questions and themes I am considering in this thesis are:

- What kind of framework is needed for designing a successful ubiquitous social networking application for mobile devices?
- How do communities, with their specific needs, inform and contribute to the design process when designing ubiquitous social networking applications for mobile devices?

These research questions and themes are investigated via background research activities and an actual "Fusion Mobile" case study, where the aim is to develop a prototype that is used in collaboration with the communities ("users") to test our user interface design.

1.5 Framework and Scope of this Thesis

This thesis is organized into three main sections (Table 1). It begins by 1) explaining the history of project in which the Fusion Mobile case study has been prepared (as it is based on prior software development work). Following that is, 2) a description of the background work that was done to develop the initial Fusion Mobile prototype, including the co-design sessions in which the Fusion Mobile prototype was tested and iterated collaboratively. Finally, 3) lessons learned from the design process are documented and reflected upon.

Part 1	Introduction
Part 2	Background Research: project history, the practice of video sharing, design challenges, design framework, benchmarking study
Part 3	Developing the Prototype for Fusion Mobile: design process, integrating the hypothesis, prototyping, co-design sessions
Part 4	Lesson Learned: Outcome and final thoughts
Part 5	References
Part 6	Appendices

Table 1 Thesis Structure

It would be impossible to cover all aspects and variants of mobile application design and ubiquitous social networking in one thesis. Thus, it is important at this point to note what this thesis will cover:

- developing an initial Fusion Mobile prototype (proof of concept) that is tested with a user community to determine the viability of the concept
- further developing the prototype via feedback gathered via the communities
- researching effective methods of ubiquitous social networking for mobile devices

This thesis will not cover:

- building the most up-to-date graphically advanced mobile software application possible
- having an application that works perfectly, in all scenarios
- creating a critique on mobile software development methods or technologies
- building an application that works for the general public, rather than user specific communities

An additional list of terms important to understand in this thesis can be found in the glossary (Appendix 6.4).

2 Background Research

2.1 Project History

In order to understand this thesis, it is important to understand that this research and prototype building is being carried out within the context of an ongoing research project, P2P-FUSION. Additionally, this thesis builds upon the foundation that our project partner in Hungary (Budapest University of Technology and Economics, BME) conducted for P2P-FUSION regarding social processing tools and how audiovisual files are processed within different types of communities. In their work *State of The Art in Social Processing*, the researchers in Budapest closely examined six different community types and how each had a special set of unique requirements for social processing tools (e.g. commenting, annotation, rating, etc). Thus, this thesis builds further upon the concept of creating a toolkit for mobile audiovisual file sharing with a specific type of community in mind.

As the original P2P-FUSION *Description of Work* states: “Media culture that builds upon the work of others has already exploded on the Internet. However, this development has been slow in the domain of audiovisual media, due to 1) internet technologies that do not adequately support creative audiovisual applications and 2) systems and social practices for intellectual property and rights management that have not evolved to match the capabilities of everyday-life digital systems.” (P2P-FUSION Consortium 2006) The aim of P2P-FUSION is not to develop one, specific social media application, but an open-source toolkit (Social Media Toolkit or SMAK) on top of the Fusion platform. This way, users are enabled to build different types of media sharing applications (as well as new components) for the toolkit.

Thus, the P2P-FUSION Project operates by developing an open, inclusive, and extensible technology platform and by collaborating with real user communities with ever-evolving social practices.

Goals

In practical terms, the Fusion project aims to create an integrated, easy-to-use peer-to-peer system – the Fusion platform – that allows anyone to publish audiovisual content to the audience they want, without the need to set up and manage video servers and complicated publishing and content management systems. The P2P-FUSION project has been in production since 2006 and many parts of the desktop software have been, or are in the process of, being completed. The thesis will focus solely on discussing what has been completed after January 2009 and the mobile version of the P2P-FUSION software.

2.1.1 Introducing the Co-design Approach

The Fusion system and the SMAK Toolkit are being designed via a co-design approach. Co-design is a philosophy that states that products and services should be designed in conjunction with real user communities in order to achieve the best possible results. Specifically, it is defined in this thesis as “...the creativity of designers and people not trained in design working together in the design development process...” (Sanders and Stappers, 2008, 5-18).

In addition to being part of Arki’s overall research methodology, co-design is an effective methodology to use when a project includes user communities. By engaging in a “shared dialogue (e.g. semi-structured interviews), a common short term project, and allowing for spaces for reflection (e.g. workshops)...”, Arki can produce design research that “...contribute[s] to the ongoing debate of what can be fruitful design research activities...[and to] try to make the need for these kinds of dialogues visible in the society at large, as well as in specific design contexts.” (Botero, Kommonen, Oilinki, Koskijoki).

Co-design and Researching Innovations

Co-design is also a useful methodology when researching and designing new and innovative products or services. As Eric von Hippel, Professor and Head of the Entrepreneurship Group at the MIT Sloan School of Management, states in his book *Democratizing Innovation*:

“The idea that novel products and services are developed by manufacturers is deeply ingrained in both traditional expectations and scholarship. When we as users of products complain about the shortcomings of an existing product or wish for a new one, we commonly think that “they” should develop it—not us. “ (von Hippel 2005, p.19)

However, withstanding a few notable exceptions, the traditional concept of the lone genius working alone in his or her lab until he or she achieves brilliance is no longer relevant. For example, in 1998 the Lego group released Lego® Mindstorms™, a product that was essentially a buildable and programmable robot. The innovative idea behind this product release was to make publicly available the documentation of the firmware and software of the product. By making this bold move, Lego hoped to open up the design to everyone and leverage user creativity to expand and develop the product line. The gamble paid off and the Lego Mindstorm series has become the best selling product in the group’s history, with over 1 million units sold. This incredible success story has resulted in other large companies (including the BBC, the US Navy and Nokia) following suit and opening up their design processes to outsiders. In fact, this type of success has started a fundamental shift in the way that companies and designers view the entire design

process. (Visanen 2008, p.1)

No longer closed factories on a hill with a fence around them, designers must now strategically manage their innovative design ideas and be open to all sources of inspiration, especially from users of their products. Innovation expert Henry Chesbrough, Professor & Executive Director at the Center for Open Innovation at The University of California at Berkeley, feels that innovation should be an entirely open process, and that:

“...Open Innovation companies invite the customer into the innovation process as a partner and co-producer. Here, the mind-set shifts to “Here are some of our thoughts, and here’s a product that features them...What can we do to help you do something even more useful?” (Chesbrough 2003, p.56)

Chesbrough also points out that:

“It is not the technology per se that matters, but technology in use. And that precisely what is so hard to predict ahead of time. Nevertheless, technological breakthroughs that do end up shaping our social practices can produce huge payoffs, both to the innovator and society.” (Chesbrough 2003, p.IX)

By using co-design methods and having the end user community work as a “partner”, we hope in my research group to truly understand our user communities’ social practices and, consequently, research and develop appropriate products that fit their lives. As von Hippel puts it:

“... if users develop and modify products to satisfy their own needs, then the innovations that lead users develop should later be attractive to many.” (von Hippel 2005, p.23)

Thus, since the P2P-FUSION project focuses heavily on community involvement, co-design is an appropriate methodology to use in order to gain a true multi-user perspective.

Co-design Enables New Perspectives on Product Development and Use

But true understanding of others, or being open to new interpretations, is only one of many reasons for choosing a co-design methodology. For example, as Tuuli Mattelmäki wrote in her doctoral dissertation “Design Probes” for the University of Art and Design Helsinki:

“Companies face new challenges as design and technology change. They used to compete for progress or quality, but now almost all have

access to the same technological components. One must keep up with development. Companies must find new ways to differentiate their product from a competitor's invention, and commit their customers. Furthermore, the awareness of people's experiences and the increasingly multicultural market have imposed new demands on design.” (Mattelmäki 2005 p.27)

These new demands mean that once we all have the same basic components to work with, there is very little that will differentiate products or services besides innovative ideas for the uses of technology. Thus, this is the area where research and development with real users becomes crucial.

Roles & Responsibilities

Arki Research Group

The role of the Arki Research Group is to function as the project coordinator for a consortium of universities and research institutions that are participating in the P2P-FUSION project. The Arki Research Group is an important part of the Media Lab at the University of Art and Design Helsinki (TAIK). The Arki Research Group began as the Project Coordinator of the P2P-FUSION project in 2006.

Universities, Research Institutions and Governmental Agencies

The project participants and stakeholders included:

- The University of Art & Design, Helsinki (TAIK) (FI)
- Helsinki Institute for Information Technology (HIIT) (FI)
- Delft University of Technology (NL)
- Sound and Vision (NL)
- KnowledgeLand (NL)
- Budapest University of Technology and Economics (BME) (HU)
- National Audiovisual Archive (HU)
- EU Commission (EU)

This project was subject to regular reviews by the EU commission and built upon previous EU projects that contained themes such as: digital rights, access management, sharing and distributing information and social media production. (P2P-FUSION Consortium 11)

User Communities

User communities played a very important role in the shaping and development of this project.

The Arki Research Group initially worked in close collaboration in the co-design process with three main user communities: a Parkour community (a group of people that gather together spontaneously around events to practice a discipline that resembles self defense), an Acrobatics community, and the Helkanuortenliitto community (Finnish folklore). The communities were involved in the co-design process and were met with regularly. This thesis will focus on taking the results from the first co-design session with the Parkour community and building and testing a prototype with their community along with a new community of Mobile Developers. The new community, the Mobile Developers, will have similar goals of wanting to share a private space for the exchange of audiovisual files with the freedom of not being bound to a desktop computer. It is important to note that while the Mobile Developers is a group of friends, they currently do not have a formal organization as a community outside of our testing purposes. The participating community members are introduced in more detail later in section 3.

Innovations

It is this focus on communities which exist offline (and in some cases online as well) that sets Fusion Mobile apart from several of the dozens of other mobile file sharing applications in the marketplace. The communities we are working with generally have something in common in the “real world” and are not only online communities. Thus, P2P-FUSION’s innovativeness is the fact that the project provides a tool for real-life communities to facilitate their social practices.

As the original P2P-FUSION *Description of Work* states, other specific innovative aspects of this project are:

- collaboration activities to encourage communities in developing extensions and applications
- participation from various stakeholder groups in society
- support for addressing and legally distributing fragments of audiovisual content via P2P networks

2.2 The Practice of Video Sharing

The Fusion platform and the SMAK toolkit developed in the P2P-FUSION project aim to facilitate sharing of audiovisual media, particularly videos, among people. Due to the explosive growth of video sharing websites like YouTube, the practice of video sharing has grown rapidly over the past few years. As stated in *Video Republic*, a report prepared for the European Cultural Foundation, many current practitioners in this field are young people who are interested in making their voices heard. And as this current generation grows up “...they will find that their reputation precedes them – it will be harder and harder to opt out of an online public persona...” (Bradwell, Hannon, and Tims 68) Unlike today (2009) where an online persona often merely augments a “real-life” persona, it is likely that in the future an online persona will become an enmeshed

dimension of a real-life persona. Of course, this type of meshing of public/private life has both positive and negative attributes, but overall it means that practitioners (and developers) of video sharing must adapt to the realities of this new practice.

Going forward, it is important to note that in the future:

“...online video and new media projects may cease to be synonymous with ‘young people’ – and perhaps all the better for it. The Video Republic already drives inter-cultural exchange; it should also become a site of inter-generational exchange. By giving people of any age a greater array of tools to influence their peers, their ideas and our public debates, we can also open channels for more direct, expressive relationships with each other and with our democracies...”
(Bradwell, Hannon, and Tims 2008, p.75)

Thus, upon realizing that the evolution of the practice of video sharing has a multi-generational effect, working to develop useful and supportive tools for different types of practitioners is of utmost importance.

Like desktop file sharing, mobile video file sharing is currently undergoing growth as seen in the benchmarking study included (Appendix 6.3). However, this is a different type of practice with its own unique set of design problems.

2.3 Design Challenges in Mobile Application Development

Mobile user interface design and file sharing, while not exactly in its infancy, is still far less developed than its desktop counterpart. While this is largely a function of the relative newness of the medium, the limitations of mobile devices also play an important role. For example, some general design limitations constraining mobile devices include:

- interruptions that occur while using the device (e.g. background noise, service disruptions)
- text input often needs to be done with only one hand due to other activities occurring at the same time (e.g. holding a bag, driving)
- small display screens
- slow or unreliable Internet connections
- short battery life
- fees from service providers associated with data transfer limit downloading
- context of use (see below)

2.3.1 Context of Use

Nadav Savio and Jared Braiterman, PhD, have developed a model of how mobile interactions occur in practice (Figure 3). In comparison with traditional interactions using desktop PC's, Savio and Braiterman state that: "...for mobile computing, context is everything. Freed from the relative homogeneity of the desk-bound PC, mobile interactions are deeply situated. In order to design for successful mobile interactions, we must understand the overlapping spheres of context in which they take place..." (Savio and Braiterman 2007, p.2) For clarification, their model is reproduced below.

Here, we can see that unlike traditional software applications, it is possible that a practitioner of mobile file sharing could be in a new environment each time an interaction occurs. Due to the context being unknowable, the application must function equally well whether used at home, on the bus, or while taking the dog for a walk outside in the woods.



Figure 3 Reproduction of Savio and Braierman's Model of Mobile Interactions

2.3.2 The “Swiss Army Knife” Metaphor

Another design problem specific to mobile interaction design is the confirmed status of mobile devices as a multi-tasking appliances. Donald Norman, professor emeritus of cognitive science at University of California, San Diego and author of many eminent design usability books, first coined the “Swiss Army Knife” metaphor when he was writing about information appliances (e.g. personal computers, televisions) and how these devices try to be everything to everybody. For example, a television cannot only be used for watching TV or movies, but also for connecting to the Internet, displaying pictures, playing music. Thus, Norman’s “Swiss Army Knife” metaphor is used today in many books and research papers on usability when describing a tool or product that does many things, but none particularly well. (Norman 2003, p.56)

In their book *Mobile Interaction Design*, Matt Jones and Gary Marsden note that mobile devices often end up in this “Swiss Army Knives” category and they wonder why there is generally so much unused potential in many mobile applications:

“Why are basic mobile devices (phones) and services so successful (voice and messaging), while the uptake of more advanced gadgets and applications is frustratingly sluggish? Answer: the former meet basic human desires in simple, direct ways.” (Jones and Marsden 2006, p.5)

Like a Swiss Army Knife, most people only use their mobile devices for one or two actions (though the device is probably capable of much more). In a study on converged appliances (e.g. mobile devices that have many applications) performed with The University of Melbourne, Monash University, and Aalborg University by Steve Howard (et al. researchers) found that:

“...Participants also often reported frustrations related to the use of converged devices not providing a positive user experience, designs pushed beyond their usability knee (clear in diaries, scrapbooks and interviews). For example, several participants were using Blackberry devices for diary, contacts and mobile email access with high levels of satisfaction, though all complained about the usability of the built-in mobile phone when compared to a dedicated mobile phone...” (Murphy, Kjeldskov, Howard, Shanks, and Hartnell-Young 2005, p.7)

Thus, it seems that even if a product is technically capable of an action, it will not be used unless it performs the action rather well. But poor usability is not the only reason why people do not use many currently available mobile applications. As Jones and Marsden again point out:

“If a mobile does not provide highly valued functionality, it will not be used, no matter how well designed the interface is.” (Jones and Marsden 2006, p. 39)

Since mobile devices are in the business of not only providing phone service, but also showcasing the latest and greatest in technology (in an effort to increase revenue for service providers), one needs to remember that at the end of the day the function a mobile performs best is enabling communication with other people. And of course the purpose of communicating with other people is to build and strengthen new and existing relationships. The additional features in mobile phones (e.g. cameras) by themselves are not the key, but what matters are the additional features in conjunction with the mobile device.

As Jones and Marsden state in a simple equation:

“Camera plus phone does not equal camera. Camera plus phone equals social awareness and relationship building device.” (Jones and Marsden 2006, p.313)

Thus, if a mobile device is able to increase social awareness and build relationships (in part due to its portability), it seems that they might also prove useful in ubiquitous social networking. In a way, users of mobile phones already carry their social network around with them everywhere they go: in the list of phone numbers that are stored in their phone. Applications such as cameras, SMS (Short Messaging Service), and file sharing tools simply leverage the information stored in the phone in order to allow users of such devices feel closer to each other.

Still, like in any type of design, the odds are that a certain framework can increase the chances for a successful implementation of the original concept. When discussing the reasons for the success of what is considered a “perfect” mobile application, SMS, Jones and Marsden state that:

“...cost, low intrusion, expressiveness and meaning, turn taking, privacy...” (Jones and Marsden 2006, p.62) all lead to the success of SMS. Furthermore, in their opinion, the best way for mobile application developers to begin developing a new “perfect” application is to: “...identify an small, coherent set of functions users really want and deliver them in a simple, direct way...” (Jones and Marsden 2006, p.36) with “...a [clear] beginning, middle, and end....” (Jones and Marsden 2006, p.90)

Keeping these ideas in mind, as well as the mobile context of use model, will help a mobile application designer remain focused on a few best practices while building a specific framework.

2.3.3 Additional Issues of Note for Fusion Mobile

In terms of the Fusion Mobile project, the afore-mentioned constraints need to be taken into account, as well as additional issues specific to Fusion Mobile. For example, when designing the user experience for Fusion Mobile it is especially important to:

Develop and Design a User Experience that Considers the Community

Since Fusion Mobile is intended for real user communities, it is essential that the application take into account real communities that use it. Since the degree of familiarity with technology can range wildly within a community, it needs to be easy enough for even the most inexperienced user to feel that they are comfortable. Even something as simple as adding a personalized welcome screen or a friend list might be enough to give users a way to keep up with what is happening in their own social network.

Make the Experience Pleasant

The user interface design of Fusion Mobile needs to be simple enough that it can become a part of everyday life. For most of us, it is not a hassle to check SMS messages on our mobile phones. This is not only because we are used to doing so, but also because it is simple act requiring only a few clicks and a few seconds of our time. We can check a message, connect with a friend, and go about our business. Fusion Mobile needs to keep that type of simplicity in mind in order to have a chance to become integrated into daily life. Further, it is important to balance keeping Fusion Mobile consistent with the desktop version of Fusion, but at the same time allow it to have a simplified user interface and additional features that are needed for the mobile use in particular.

2.4 Design Framework: 4C's

After completing a review of some relevant literature in the field, I began to build a design framework with the goal of finding key factors in successful mobile application prototype design. This thesis hypothesizes that in order to develop Fusion Mobile as successful mobile application prototype (as stated in Research Objectives section 1.4), with an emphasis on ubiquitous social networking, attention should be focused on what this thesis will refer to as the 4C's: constant contact, collaboration, community and co-design (Figure 4).

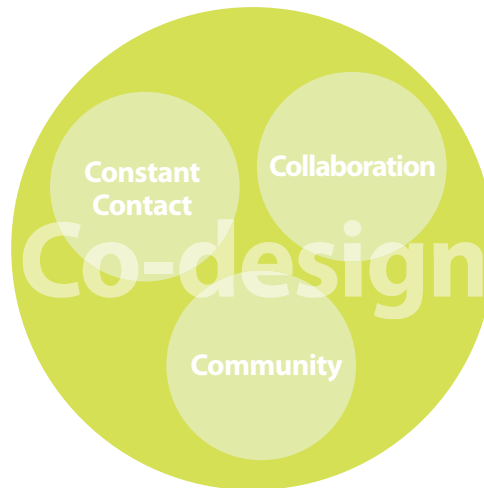


Figure 4 Visualization of the 4C's

More specifically, attention first needs to be paid to the concept of “ambient awareness” and how it affects users of mobile devices; secondly, a thought-shift about how the Web functions as a collaborative platform needs to occur; thirdly, the interaction between social networking communities and changing demographics needs to be examined; and lastly, the motivation behind designing mobile applications with real user communities needs to be understood. The principles of these four ideas are mapped below in greater detail.

2.4.1.1 Constant Contact

What is “Ambient Awareness”?

The first C, constant contact, is referenced in an article from *The New York Times*. It refers to the concept of a constant online presence, with frequent status updates, as “ambient awareness” (when used within a social networking framework). The author of the article states that:

“Social scientists have a name for this sort of incessant online contact. They call it ‘ambient awareness.’ It is, they say, very much like being physically near someone and picking up on his mood through the little things he does — body language, sighs, stray comments — out of the corner of your eye.” (Thompson 2008)

A few years ago (before the advent of blogging, micro-blogging, and location-based services), when publishing a webpage was far more complicated, the idea that one would constantly be accessible online and spend their time announcing tiny, incremental updates to the world (e.g. “I just ate a sandwich.”) would have been almost unthinkable. The whole process of updating and publishing a page was often complicated and time consuming. Many times web designers would do a large series of updates all at once, in order to avoid the hassle of having to publish the pages

over and over. But today, with the enormous improvements made in web technologies, the process has become far simpler. Still, the idea of focusing on publishing the seemingly insignificant remains an odd concept to many, including Alex Beam, a well-known technology columnist for *The Boston Globe*. As Beam was quoted:

“Twitter [the microblogging service], in particular, has been the subject of nearly relentless scorn since it went online. ‘Who really cares what I am doing, every hour of the day?’ wondered Alex Beam, a columnist for The Boston Globe, in an article about Twitter last month. ‘Even I don’t care.’ (Thompson 2008)

But interestingly, this is what it often gets people (especially younger users) hooked. Letting your friend know that you just ate a sandwich will obviously not change the world. However, what is a big deal is that each of these little bits of information, when added up, can allow for a deeper social connection in the long run. After all, this method is remarkably similar to how one creates relationships in day-to-day life. Real relationships are not about having a polished CV where you present only your best qualities, but about letting someone see the really small, boring details that your life is made up of. They are about letting someone see you before you have taken a shower, or before your morning cup of coffee, or any of the times where you are not actively controlling the image you present to the world.

Fusion Mobile, therefore, could allow people within a community to share the silly or mundane; thoughts, images, or ideas that might not warrant an immediate email or phone call, but are still something a user would to share nevertheless.

And as *The New York Times* article about ambient awareness summarized:

“This is the paradox of ambient awareness. Each little update — each individual bit of social information — is insignificant on its own, even supremely mundane. But taken together, over time, the little snippets coalesce into a surprisingly sophisticated portrait of your friends’ and family members’ lives, like thousands of dots making a pointillist painting.” (Thompson 2008)

Thus, it seems that ubiquitous social networking applications that allow for ambient awareness are able to achieve a considerable synergistic feat: to make something out of almost nothing.

Social Networking and the Next Generation

Although social networking and ambient awareness can be seen as recent phenomena, there are

already marked differences in user behavior between different demographics.

One recent study, conducted by The Centre for HCI Design at City University London, has shown

“...significant differences between the friend networks of teenagers and older users...[and] that teenagers tend to have much larger networks of friends compared to older users... our sample of older users tend not to have many friends...” (Arjan, Pfeil, Zaphiris 2008, p. 2739-2744)

Indeed, while it still remains to be seen what happens once the newness of social networking wears off, communities with younger users seem to be almost infatuated with social networking. And while communities with older users might not feel as comfortable with this type of technology, or about the fact that privacy can be easily compromised if not careful, it is nevertheless worth investigating the traditional “with age comes wisdom” school of thought. Perhaps it is the case that younger users simply will not perceive a loss of privacy, as such. Additionally, having grown up with these types of technologies, perhaps there is something that younger users are able to teach older users.

In an article that discusses the differences between different groups of users of social networking sites, Danah Boyd from the University of California-Berkeley, writes:

“...social network[ing] sites have complicated our lives because they have made this rapid shift in public life very visible. Perhaps instead of trying to stop them or regulate usage, we should learn from what teens are experiencing? They are learning to navigate networked publics; it is in our better interest to figure out how to help them.” (Boyd 2007, p.23)

Interestingly, upon looking more deeply at the demographics of who is accessing social networking sites via their mobile phones, there are some interesting statistics. For example:

“Interest in using the mobile phones and handheld devices to access social networking sites is still concentrated in young adults (18-24), but has spread a little to slightly older groups (25-34)

About 20% are quite active on their social networking sites in terms of uploading images and using other applications, which for a relatively new Internet service is nevertheless impressive.

It may not be as integrated into people's lives as email, but after just a few years of existence as a service a 25% of those with social networking sites thought that loss of access mattered, and 50% of those, clearly the committed ones, thought that it would ruin their day."

This research, conducted by Dr. Leslie Haddon, a specialist on information and communication technologies based in the Media and Communications Department at the London School of Economics, shows that in just a few years social networking sites have carved a unique role in to the lives of users that frequent their services. The full impact of their role will not be able to be known, however, until these younger users come of age and enter adulthood. (Haddon 2008, p.4-6)

Questioning the Value of Social Networking

Still, the current explosion of social networking sites, and users of such sites, has lead many people to openly question their true value. Several early, high-profile failures, including the very public failure of Friendster (whose founder Jonathan Abrams turned down a 30M USD offer for his company from Internet giant Google only to end up with a company that ran out of money and that did not have any working software), have lead many to question the value of such sites. (Rivlin 2008),

For example, as an article in *The New York Times* remarked "...roughly once a week, David L. Sze, a venture capitalist at Greylock Partners, hears from entrepreneurs who say they have the next MySpace, the copycat social networking site that has trounced Friendster. 'The counter to that is, 'Tell me why you aren't going to be the next Friendster,' Mr. Sze said. 'It's become the iconic case of failure.' " (Rivlin 2008)

For many, these types of public failures have lead to the belief that social networking is just a fad and will play out like every other fad on the Internet: huge amounts of money being thrown at anything that even resembles social networking, only to inevitably discover that there is no way for anyone to make a sustainable business out of them. Thus, in building this prototype I have made a conscious decision to try to stay away from fad-like aspects of social networking and concentrate only on a few core offerings.

2.4.1.2 Collaboration

Transformation of Web from an Informative to a Collaborative Platform

The second C is about collaboration. As experienced designers know, no design work exists in vacuum. The flow of influence tends to be multi-directional: from companies influencing

designers, to designers influencing companies, to designers influencing others designers, and so on. As Santtu Toivonen, a researcher at the VTT Technical Research Center of Finland, has expressed in his research paper titled *Web on the Move: Landscapes of Mobile Social Media*, the web has picked up many of these types of collaborative principles and has undergone an important shift from individual publishing towards community collaboration. As Toivonen sees upcoming trends in social media:

“...Massive collaborative activities via the Web is a clear trend. The Web has already changed from a platform for searching information into a community platform. People are social by nature and the Web is the best possible invention/media for facilitating this...Peer production is gaining popularity...” (Toivonen 2007, p.10)

This has already clearly occurred in community-built web pages, such as Wikipedia and blogs, where users (besides the original author or creator) can edit or leave comments. Additionally, this trend has headed one step further towards users re-purposing and re-mixing content from different sources. Applications that combine two types of previously unrelated content (e.g.. mashups or remixes) have already been in use for several years. Enthusiastic community members who edit and add information due to personal interests appear to be driving these sites. Many times, it is not just one person who owns all of the content, but a group of people who pool their knowledge in order to offer the best or most interesting knowledge.

In order to have a successful, collaborative, social media site, Toivonen states that it is essential to: “Include enthusiasts who produce vast amounts of content, comment it, share it, and so on.” (Toivonen 2007, p.24)

As evidenced even in the early days of the web, frequently updated sites get repeat visitors. Pages that contain old, outdated or boring information quickly become obsolete and are rarely revisited. The same appears to apply to applications such as Fusion Mobile that will rely on users posting content regularly, if no one keeps the content fresh by constantly updating status messages or posting new items, it likely will become infrequently used.

2.4.1.3 Communities

Importance of closed communities on the web

The third C for this thesis covers the importance of community. As long as the web has been around, there have been concerns about privacy. While a legitimate concern, many users seem to be content giving up some of their personal privacy rights in exchange for the world of possibilities the web offers. Indeed, today’s users seem to see the web as less of a black and white situation (e.g. gain access, but give up your privacy rights) and more in shades of gray (e.g.

release only the information you wish to share). A good example of this is Facebook where, depending upon how you have set your personal privacy rights, your “friends” are the only ones that can see your personal information. This type of closed community is becoming increasingly popular as people are realizing the value of sharing, but with the right people.

In fact, based again on his research within top companies and universities (e.g. Yahoo!, Nokia, The University of California at Berkeley, and TeliaSonera), Santtu Toivonen states:

“Semi-private parts of the Web are going to be more important in the future. This includes for example invitation-only communities. Inside the open Web people have already created closed circles.” (Toivonen 2007 p.10)

Users have demonstrated a need not only for the Internet, but also for a safe and private Internet where they can leverage the power of information without putting their own personal privacy at risk. This is especially true of Fusion where many of the items that communities post are highly personal in nature (e.g. photos of young children), but still desired to share amongst group members.

Further, as Toivonen suggests,

“Understanding the shared value of a community is the most important thing...there must be some common denominator such as a hobby or other joint interest for a community...” (Toivonen 2007, p.20)

It is clear that when thinking about ubiquitous social networking and media sharing within the context of Fusion Mobile, a group must have some higher purpose in order to exist and to thrive. The use of web or mobile devices will not be the only tool used for community building, but rather an enhancement tool for bringing communities together. For example, one company that has been subject to a great deal of ridicule (and probably should not have tried community building) is a company that manufactures cat litter.



Figure 5 The Cat Litter Community

As one commenter put it: “This is way too funny. How many cats signed up for the Purina’s Breeze for Cats? I will say this. Purina created a really exclusive niche. Cat Crap.” Another user summed up the issue rather nicely: “Of course users don’t want to be social around a brand - they relate on common interests and locations, rarely on the products they buy.” (Kirkpatrick 2008)

2.4.1.4 Co-design

The fourth and final C is co-design. As before, I will work under the definition of co-design as “...the creativity of designers and people not trained in design working together in the design development process...” (Sanders and Stappers, 2008, p.5-18). However, since participatory design has also had a great influence on co-design methods, I feel it is important to state the I have also worked with Michael Muller’s definition of participatory design that states “...participatory design (PD) is a set of theories, practices, and studies related to end-users as full

participants in activities leading to software and hardware computer products and computer-based activities...” (Muller 2007, p.1)

Since products and applications need to be launched and tested before designers can see what the real outcome is, co-design and collaboration between developers and users, can help realize the true practical applications of a product or service. Thus, co-design can be especially useful while designing mobile applications. Once again, researcher Santtu Toivonen remarks that we need to:

“... Start from the everyday conventions of the users, and based on that develop services and applications, which can be used via the most appropriate available channel. In addition to the functional appropriateness, fun and serendipity are things that should be addressed. And these are things that more often than not originate from the users themselves; not from the engineers designing the systems...” (Toivonen 2007, p.11)

Thus, principles of co-design also begin to overlap into the domain of all the other C's. Nokia, with a long and successful history in developing mobile applications, has a great deal of experience with this. In the book *Mobile Usability: How Nokia Changed the Face of the Mobile Phone*, usability expert Turkka Keinonen states that:

“Our experience has been that the intersection of user needs and the industry interests increasingly takes place only after product launch...New solutions are utilized in ways that never ever occurred to their designers...” (Keinonen 2003, p.1-2)

And this is precisely why co-design is so important while developing mobile applications: it has the ability to help fuse together the themes of constant contact, collaboration, and community into a single, workable methodology.

The Social Costs of it All

It is important to keep in mind, however, that although Fusion Mobile will likely lead to increased contact amongst community members, it will also probably lead to the blending of private and public life.

As Howard Rheingold discussed in his book *Smart Mobs: The Next Social Revolution* there are at least three types of dangers associated with pan-opticon type “always on” technologies. These include:

“Threats to liberty...providing the totalitarian snoop power depicted in Orwell’s 1984...Threats to quality of life...it isn’t clear whether life in the info-mated society delivers convergence faster than it erodes sanity and civility...Threats to human dignity...the more mechanical and less humane we become...” (Rheingold 2002, p.185)

Gary T. Marx, Professor Emeritus of Sociology at MIT, has a specific term for the type of occurrence where two previously dissimilar parts of a person’s life intersect and cross each other. He defines it as a border crossing or a distinct type of crossing (natural, social, spatial & temporal, and ephemeral) that shares a common nature in that it “violate(s) the expectation by people that parts of their lives can exist in isolation from other parts”. (Greenfield 2006, p.127-8)

As Adam Greenfield explains border crossings:

“...Border crossings [are] irruptions of information in an unexpected (and generally problematic) context...the web is a generator par excellence of such crossing, from the ludicrous to the terrifying...but this all is a foretaste of what we can see coming...we can no longer expect anything to exist in isolation to anything else...It brings along with it the certainty that if a fact once enters the grid...from your Aunt Helga’s blood pressure at noon last Sunday to the way you feel about your most recent ex-boyfriend—it will acquire a strange kind of immortality...” (Greenfield 2006, p.127-8)

So for better or for worse, constant connections can strengthen and improve lives while at the same time crossing personal boundaries. Overall, Fusion Mobile should lead to improvements, but it would be naive to say that there will not be a social cost. Again, like with privacy issues, it is possible that in the future people will be less sensitive to these matters, or that there will better methods of personal protection. But for now it is reasonable to assume that this change will cause some problems, at least in the beginning.

2.4.2 Summary of the Design Framework and Hypothesis

Therefore, by means of a partial literature review, this thesis hypothesizes that in order for Fusion Mobile to be a success within the framework of ubiquitous social networking, when building our prototype we should focus on the 4C’s that were described in detail above: constant contact, collaboration, community, and co-design. These themes will be revisited and interwoven throughout this thesis.

2.5 Benchmarking of Similar Mobile Services

Having defined some important terminology, it is now time to define some of the others players in the field. Although there are many start-ups that offer live mobile streaming or mobile video file sharing services, this thesis will select only a few for a brief benchmarking study. Listed in Appendix 6.3 are some of the more well known mobile file sharing services at the time of this writing. Please be aware that this brief review below is by no means completely comprehensive or detailed. The purpose of this study is to compare and contrast a few mobile file-sharing services in terms of type, and strengths and/or weaknesses.

After I tested and subsequently benchmarked a few of the current services available for media sharing, I was able to have a better image in my mind of how the user interface design for Fusion Mobile should work. For example, from various sites I discovered the following:

Vringo (www.vringo.com)

The more simply the content is organized, the better. It is best not to go too deep into groups, subgroups, and sub-subgroups. Often, over-thinking the organization is just as bad as under-thinking it. Thus, if I cannot clearly define how the interaction design will work within one or two levels, (or why a certain function is necessary) it is probably because the concept is not yet clear or well-defined.

Shozu (www.shozu.com)

In order to keep the user interface simple and uncluttered, it is a good idea to put extra file information (e.g. size, date, format) into a tab format at the top where a user can click through it one by one without having to see it all individually listed next to the file. This also helps to keep the user interface easy to read. In general, the most successful interfaces I saw had been stripped of all extra, unnecessary information.

Ovi (www.ovi.com)

At some point, in order to manage lots of photos and videos, it will become crucial to have a desktop version of the site where the user can edit and tag their photos. While it is possible to do this on a phone, it is a far more pleasant task on a desktop PC. Additionally, the desktop experience must be fluid and easy for users to tag their content. Without the ability to have organized content, a file and photo sharing site can become somewhat useless if users are not be able to find what they are looking for.

2.5.1 General Findings from Benchmarking

Many mobile file-sharing applications have a “channel” system based (e.g. files are categorized under the “channel” that is most appropriate). This is an easy method of organizing, categorizing,

and socially enhancing specific files. File information also generally includes information such as: name, location, date, and rating. Often, mobile applications offer a dual media approach where the full-scale site is online, and essential features are available via mobile. This is a good approach in that it keeps data transfer fees down, as well as minimizing battery drainage.

It appeared that application developers tended to build for one platform (e.g. iPhone), get it working, and then build for other platforms (Symbian, etc.). Some of the applications reviewed were built only for mobile devices, while others were a mobile web version of an already working website. Some applications had the ability to integrate with current social networking tools (e.g. Facebook). All of the applications tended to emphasize “connecting and sharing experiences” and services that offered live streaming video tended to emphasize the “out in the field” angle.

Overall, the applications that I felt were the most satisfying to use were the ones that offered me less options, and the easiest interactions and a clear path from point A to point B. I began to feel that I would rather have a mobile application do one small thing really well, rather than have it do ten things in a mediocre fashion. And with this in mind, I began to think about the user interface design for Fusion Mobile.

It is important to note that different services were somewhat hard to compare because they were built using different languages (Java ME, Symbian, Android, iPhone, Python, Flash Lite, etc.). Thus, an application can have a more polished look and feel, but be less appropriate for task at hand. For our purpose of wanting to produce and test the Fusion Mobile prototype rapidly, the Python programming language was ideal, although it has limited graphic features compared to most.

Through benchmarking, I was able to build a more precise framework for Fusion Mobile. During this process I kept the concept of ubiquitous social networking component in the back of my mind, since in Fusion Mobile that is what will lead our user communities to being always “on”, but, paradoxically, in a more simple way. When trying to define precisely how users will benefit from this type of ubiquitous social networking with their mobile devices, a quote from Adam Greenfield’s *Everywhere* comes to mind. Greenfield asks:

“...What people do want [from ubiquitous computing], and will ask for, is more granular. They want...to be granted a god’s eye view of available parking spaces, to spend less time fumbling with change at the register, to have fewer different remote controls...” (Greenfield 192)

My hope is that Fusion Mobile will allow users to rapidly and easily to share minutia, and the everyday aspects of their lives. For example, a user could share the best five minutes of a presentation, rather than the entire hour. Yet ironically, it is this type of selected and focused minutia that can allow people to become closer and designers of their own lives as it allows for easy access to tiny (yet important) details which were not previously easily accessible.

After completing these background phases, Arki Research Group's software developer Aapo Rista and I started the actual design and implementation of Fusion Mobile. My role was to work on the user interface design and organizing the co-design sessions with user communities, while Aapo's role was the implementation and documentation of the Fusion Mobile software.

3 Developing the Prototype of Fusion Mobile

3.1 Design Process

The illustration below (Figure 6) details the design process and the stages that occurred when developing the prototype for Fusion Mobile.

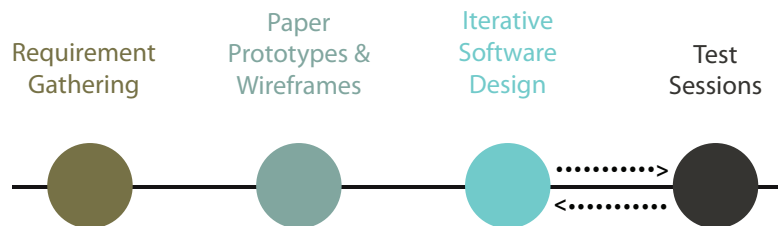


Figure 6 The Design Process

3.1.1 Requirements Gathering

During the spring of 2008, a co-worker of mine at Arki arranged co-design sessions with the local Finnish Parkour community in order to discover what their specific goals were with respect to the Fusion desktop software. Parkour, roughly from French, means “the art of movement” and enthusiasts often meet in person at “jams” or events where members of the group get together to work on training and developing their skills. Parkour activities include 1) jams which are freeform training sessions that take place in new, unexplored locations (as well as in old ones) and 2) structured training sessions in which practice is done after a teacher's example. The community is mainly interested in sharing and creatively reusing video content. Videos are important in the context of Parkour for learning tricks and for showing one's skills or development level to the community, thus allowing for critique and acclaim. Since videos are a good medium to convey Parkour movements, and audiovisual media is used among Parkour enthusiasts online (see e.g. www.parkour.tv), the prior co-design work with the Parkour community members focused largely on how they could share and socially enrich audiovisual media of Parkour activities. A Fusion

media sharing application concept was developed together with the Parkour community members to support the Fusion desktop version design (see Appendix 6.2 for more detail).

Within the course of their discussions about the Fusion desktop software, the Parkour community mentioned that due to the active nature of their events, they would also be interested in a version of Fusion that would accommodate mobile devices. For them, it would mean the freedom to practice anywhere, as well as avoiding carrying around a lot of extra video equipment. During the co-design session, the Parkour community stated that they would like the possibility to use the system to utilize content gathered with mobile devices (e.g. route information collected with a GPS device) and that it would be nice to be able to transfer this type of information, as well as videos, to the system real time or immediately after an event. In addition, they noted that YouTube-like (www.youtube.com) services currently do not adequately support sharing within specific groups. Many of their members are unnecessarily a part of many such services, and having one central service would be helpful to their community. Additionally, a more private “space” than YouTube would be nice and would enable facilitation of commenting on videos within certain groups of people.

Thus, it was with this data from a prior co-design session that I begin developing the beginnings of a mobile, user-driven prototype that could be used by a community that would like a closed, private space to exchange audiovisual files without necessarily being bound by place, as well as an easier way to transfer, edit and share video content. Based on this data, I wrote a scenario for the Parkour community that we used to in our test sessions (see Appendix 6.7.1).

The Mobile Application Developers Community Scenario

Since we had the idea of one day testing with a group of people interested in Mobile Application development, I wrote an additional hypothetical scenario (later used in a co-design session) for this group as well. The full scenario is located in the Appendix 6.7.1.

Functional Requirements Document

After reviewing the results of the Parkour test session, and coming up with a list of general requirements, I mapped these as user requirements using usability specification templates found online at Nokia.com (www.forum.nokia.com). Each task was written out, word for word, and broken down into the smallest increments possible. After completing this, I worked collaboratively with Arki’s software developer, Aapo Rista, and received his feedback about what was logical and what needed more thought put into it. The functional requirements document can be viewed in full in Appendix 6.5. Breaking down the tasks into small increments helped me see which tasks were overly complex and which tasks were easy and efficient to fulfill. Additionally, we selected basic requirements and user interface solutions based on the desktop version, since we aimed to

have consistency between the desktop and mobile version because the goal was that these would be used in conjunction. Further, if there would not be consistency in the terminology and user interface logic between the two systems, the user would be confused and have to learn a new logic for each application. Still, there were some new features specific to the mobile version that were also added after completing the background research and functional requirements, discussed in more detail below.

3.2 Integrating the Hypothesis of the 4C's into the Design Process

3.2.1 Paper Prototyping and Wireframes

The scenarios led to the development of paper prototypes and wireframes of the Fusion Mobile user interface (structure and interaction). In this section, a short description of how we integrated each of the C's from the hypothesis into our development process is outlined.

Constant contact

The goal for this prototype was to build an application that allowed members of a community to stay in constant contact with each other and to share and exchange media within a private network. With that in mind, I brainstormed features that would give communities tools to do this in a non-obtrusive way. It is important to note that in the desktop version this is accomplished through a true P2P network, but in the mobile version this happens via web bridge technology (see section 3.2.2 and Figure 10). The features that I felt would help communities achieve this goal of constant contact would be features such as:

- Chat functionality: The ability to chat with others in the same network could be useful to discuss ideas in real-time.
- Commenting: Giving the users the ability to comment on posted items would encourage discussion and the exchange of ideas.
- Event log: This could allow users to see what has been going on in their groups, even if they are away for a while.
- SMS notifications: By using the mobile's built-in ability to send SMS messages, this would allow for easy and instant notifications of events, such as invitations to join groups

Collaboration

Collaboratively speaking, these were the steps we took when building our prototype.

As previously stated, the original concept for our prototype was informed by the first co-design session with the Parkour community, performed by Arki Research Group members. I read through the results of the session and paid special attention to the areas that the Parkour Community had

mentioned would help support their community. Some of their ideas (e.g. GPS tracking) while innovative, were not able to be realized at this time. But other ideas, such as commenting on content were developed further.

Initial Paper Prototypes

Doing the initial sketches by hand was far faster than using a computer. If I needed to test some ideas really quickly, there was nothing better than a pen, paper and some post-it notes. After sketching my rough ideas, I showed them again to our software developer Aapo and we refined them based on what was technologically feasible. After I was reasonably happy with the hand-drawn sketches, I proceeded to do the final, pre-development sketches using Omni Graffle and Adobe Illustrator. These were further refined during a series of collaborative meetings with our software. Below are some samples of the initial sketches, done on paper.

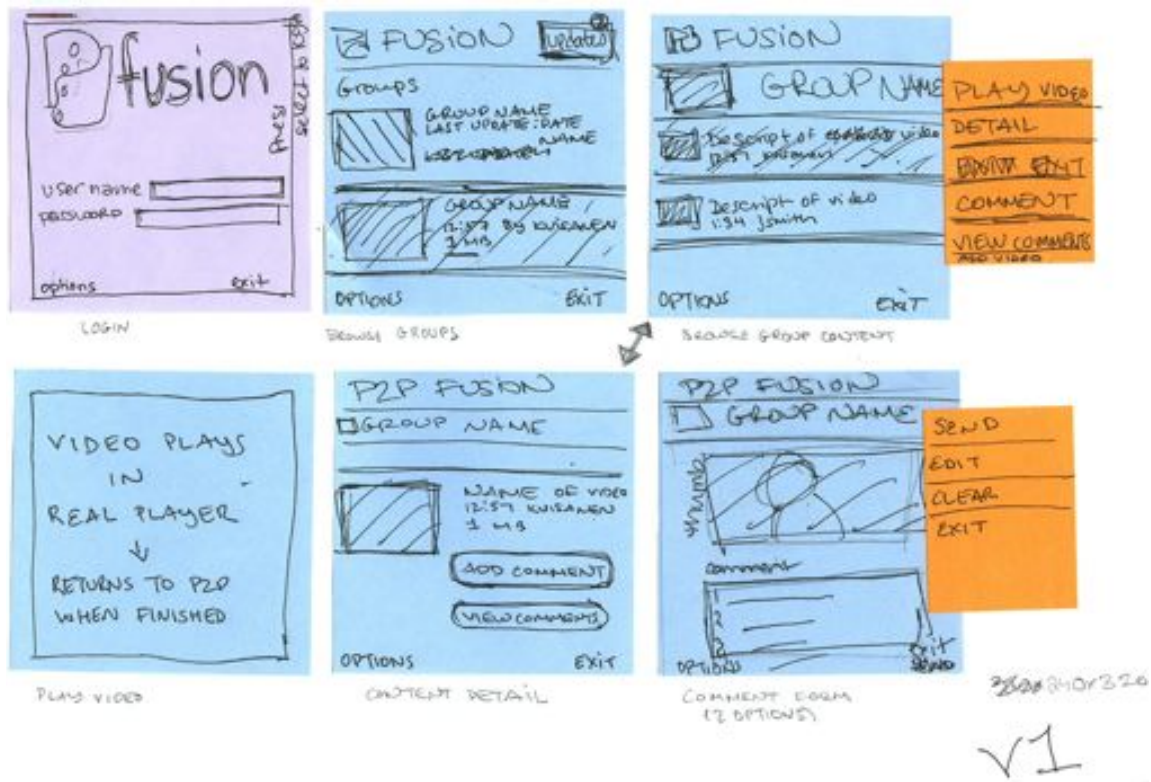


Figure 7 Paper Prototype 1

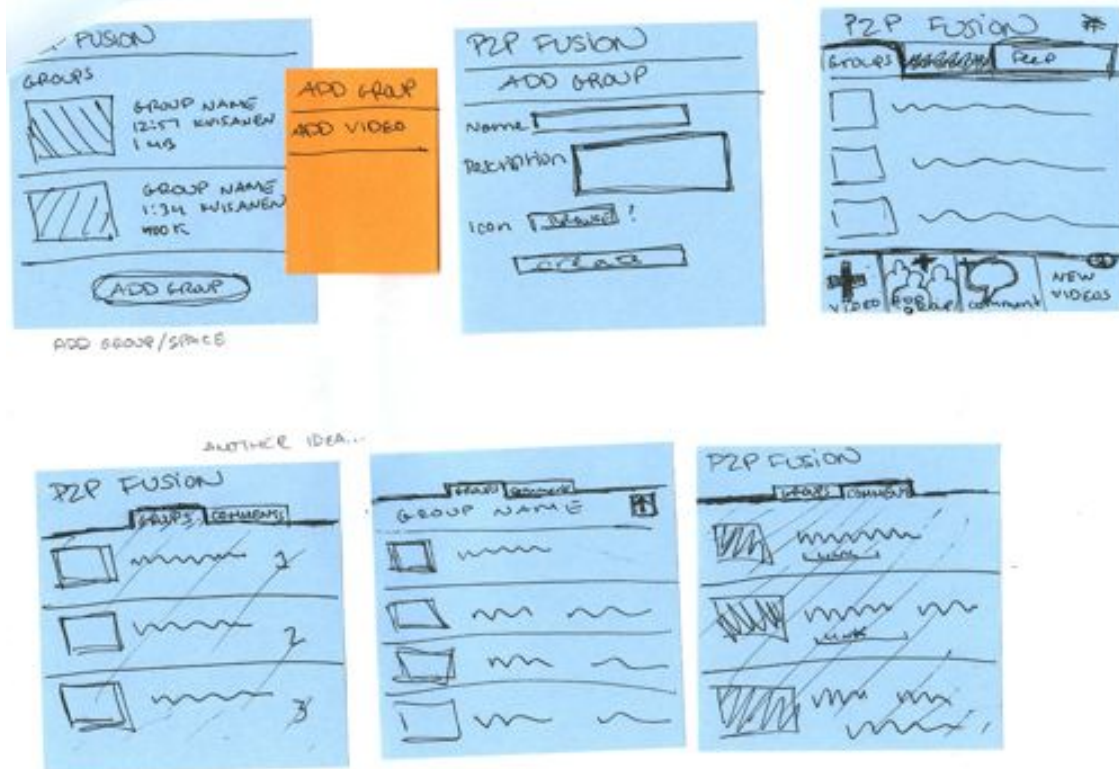
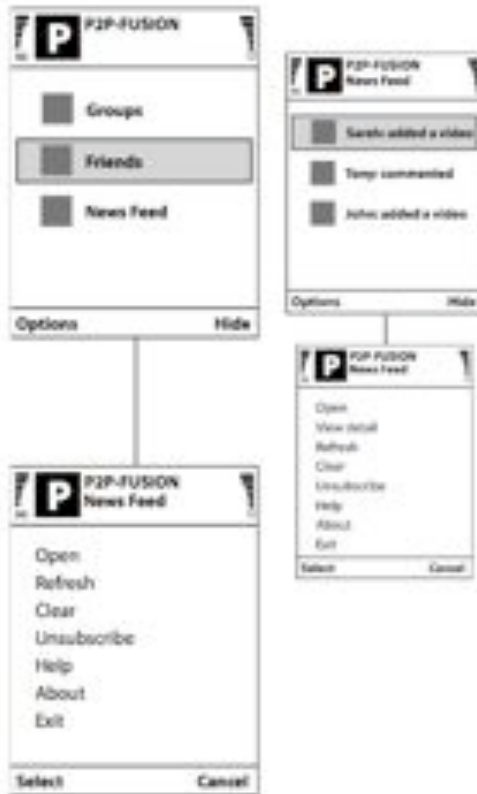
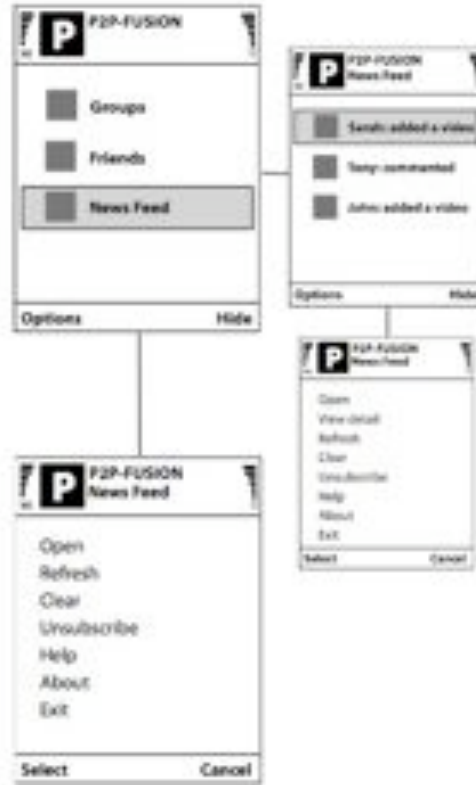


Figure 8 Paper Prototype 2

FRIENDS



NEWS FEED



GROUPS



Figure 9 The final pre-development wireframes

3.2.2 Implementation of the Initial Fusion Mobile Prototype

After I finalized the wireframes, our software developer Aapo began work on building the prototype. Using the Python programming language, the prototype was built in several stages. Generally, the technology underlying the project consisted of a multi-layered approach and is illustrated below. Again, it is important to realize that in our prototype, one computer acts as the “node” through which files are shared for all users.

Layer 0	Peerscape, P2P network
Layer 1	P2P Fusion “core” that provides functions to: list groups and content, add groups, add content, add comments. This mirrors what is on the desktop version.
Layer 2	Web bridge, based on Django web framework. This handles incoming requests and “redirects” them to the Core. The incoming requests contains one mandatory parameter: operation, which may be: get_grouplist, get_contentlist, get_content_file, add_comment, add_entry, create_group
Layer 3a	Remote client (mobile or other) that must know what kind of requests it has to make to communicate successfully with web bridge. Includes a special communication library, which simplifies creating requests and handling responses.
Layer 3b	Nokia Series60 mobile client which is capable of displaying a graphical user interface (GUI). Uses native Series60 widgets to render the GUI and uses underlying communication libraries to communicate with the web bridge.

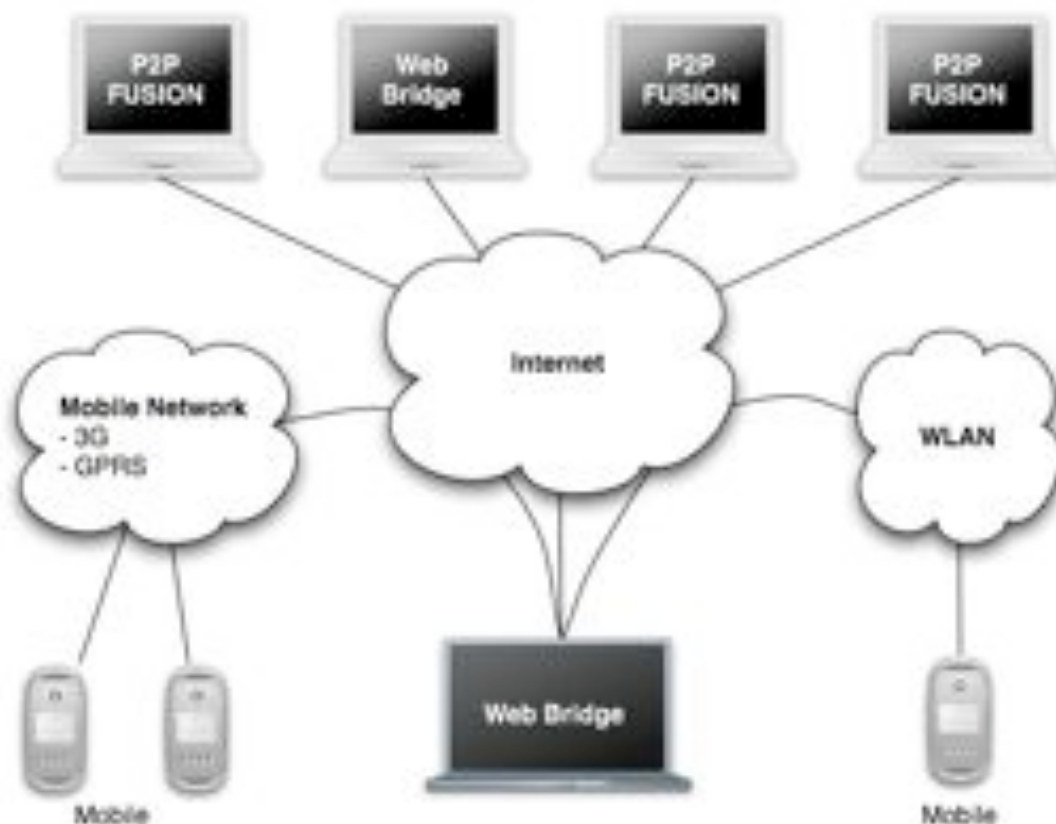


Figure 10 Visualization of Web Bridge Technology

Arki's software developer Aapo worked to build the prototype and we would test it amongst ourselves every day. Sometimes things that we discussed did not work in practice, so we refined the prototype iteratively. After we had completed most of the original functionality we had outlined, we decided to test a bit more with members of our research group. Then, after building a fully-functioning prototype for the Nokia s60 mobile phone, the functionality needed to be tested by our communities.

Community Testing

Two test sessions were held in March 2009 where we gathered feedback about our prototype and where we could make improvements.

The first session, held with a Parkour community member, tested whether or not the prototype we built was suitable for their community and whether or not the user interface functioned in a way that helped them achieve their goals concerning mobile video and photo sharing. The initial Fusion Mobile prototype was used in this session. Based on the feedback received from the Parkour community member, the prototype was improved prior the second co-design session.

The second session, held with the Mobile Developers, looked to see where we could make additional improvements to our user interface and interaction design. Again, the prototype was improved after this session based on the feedback we received, and ideas for further development of Fusion Mobile were noted. A few days after the session, Aapo and I discussed what types of methods we should use to encourage others to develop this prototype further and how best to get a community of mobile developers involved in the process of future development.

The conduct and outcomes of the co-design sessions are presented in more detail in the following after describing the general procedure of the sessions.

3.2.3 Community Co-design Test Sessions

General procedure/conduct of the co-design sessions

Arki software developer Aapo Rista and I were present in both of the co-design sessions. My task was mostly to moderate and document the sessions, while Aapo took care of the technical issues and participated in testing the prototype with the community members. The documentation of the sessions was done by taking notes and photos, and by recording video. I also took screenshots of the prototype user interface after the sessions were completed.

The co-design sessions generally followed the same structure presented in Table 2 below.

Agenda: Co-design Session	Objectives
1. Welcome and introduction	1. To give an overview of the project
2. Scenario reading	2. To allow the participant time to adjust To test the prototype and gather feedback from the participant via a free exploration of the software
3. Working session	
4. Wrap-up and conclusion	3. To allow final thoughts, feedback

Table 2 Sample Agenda for a Co-design Session

After welcoming the participants, and serving them refreshments, a general introductory presentation was given about the Fusion Mobile, and how it relates to the desktop version of Fusion (Appendix 6.7.2). Some of the participants were already familiar with the desktop version of Fusion, as they had been using an earlier version of it during fall 2008.

At the beginning of each test session, participants were given scenarios to help place themselves in the mind-set of a video-sharing practitioner. The hypothetical scenarios, included in Appendix 6.7.1, contained tasks that a user would realistically like to achieve while using the Fusion Mobile software. The scenarios were different for the two sessions, as the participants' backgrounds and

interests differed. After discussing the scenarios briefly, the participants tried out the pre-installed Fusion Mobile prototype on the test phones. Login names were given to all participants and a pre-existing WLAN Internet connection allowed them to connect to the web bridge via Nokia N95 phones that were provided. (One Mobile Developer participant, however, used the application on his own Nokia s60 phone).



Figure 11 Photo of N95 with Fusion Mobile Application. Photo © Nokia.

Since different versions of the prototype were used in the two co-design sessions, the features explored were slightly different and are explained in more detail in the following sections. The photo and video files shared between the participants (and Aapo) using the application were captured during the sessions using the test phone's own camera. A desktop version of the Fusion software was also running nearby since Fusion Mobile operates through Web Bridge technology. Further, we had a laptop available so participants could see their comments and videos being added to the desktop version of Fusion in real-time. The exploration of the prototype proceeded freely and participants were asked to think aloud and tell their first impressions. No detailed instructions were given regarding the prototype user interface, as we wanted to obtain feedback on how easy the prototype was to use. However, if the participants got stuck on something, or wondered about how the prototype worked, we provided further details on the functionality along the way.

Finally, we held a wrap-up discussion and summarized the problems encountered as well as

further ideas for Fusion Mobile development. The total duration of the test sessions was 1.5 hours for the Parkour community and approximately 3 hours for the Mobile Developers community.

One important point to note is that the set-up we used for our sessions was somewhat unrealistic, as the participants were all in the same room, and not "on the move". However, at this point of the Fusion Mobile prototype development, arranging a test session in a real-life setting would have been technically impossible. Therefore, we decided to use an indoor meeting room set-up for the time being, and perhaps conduct testing in a more realistic setting at later stages of the application development. Finally, another limitation of our sessions was that, due to limited time, we had to focus the sessions on only a few activities and themes. Our choice was to focus on issues that would advance the development of the mobile application directly, such as usability and ideas regarding the features presented in the mobile user interface.

3.2.4 1st Co-design session with Parkour Community member

The Parkour test session consisted of a member from the Parkour community performing a free exploration of the prototype (Table 3). The participant tried out the following features/tasks during the session, as these were available in the prototype used in the session:

- creating a group
- joining a group
- viewing content
- commenting on content
- exploring content from other users
- chat

Agenda: Parkour Co-design Session	Objectives
1. Welcome and introduction 2. Scenario reading 3. Working session 4. Wrap-up and conclusion	1. To give an overview of the project 2. To allow the participant time to adjust 3. To test the prototype and gather feedback from the participant via a free exploration of the software 4. To allow final thoughts, feedback

Table 3 Parkour Co-design Session Summary



Figure 12 Detail of the Parkour Co-design Session

Mobile Device/Software	Nokia N95 Mobile, Fusion Mobile pre-installed
Set-up	Closed meeting room
Documentation	Written notes, photos
Test Participant	1 male community member, age approximately 25. Graphic Designer with limited programming knowledge.
Arki Members Present	Kristine Visanen (documentation, photos) Aapo Rista (technical support & additional testing)

Table 4 Detail of the Parkour Co-design Session

Screenshots of the Parkour Test Prototype

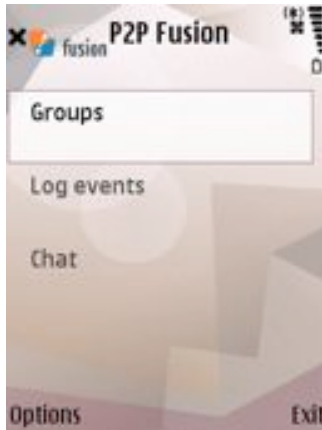


Figure 13 Task Options

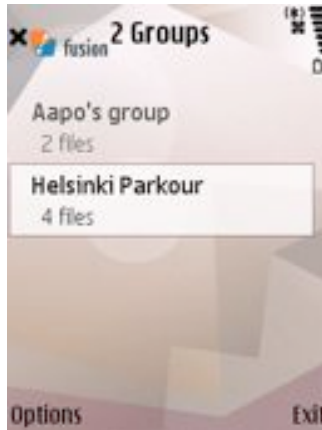


Figure 14 View Groups

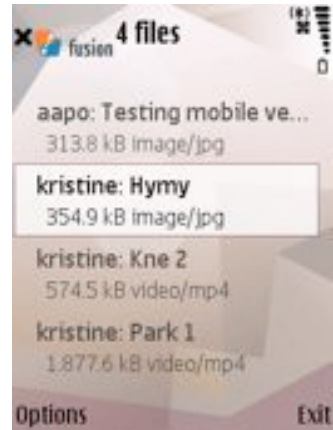


Figure 15 Select a File

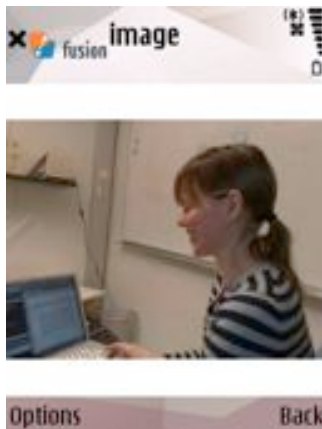


Figure 16 Native File Viewer

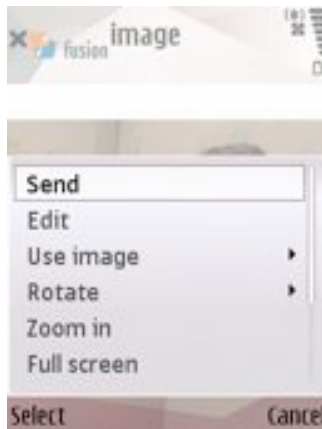


Figure 17 File Viewer Options

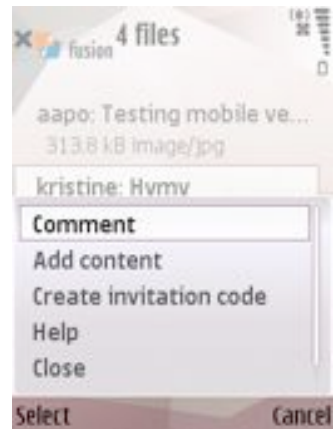


Figure 18 Comment

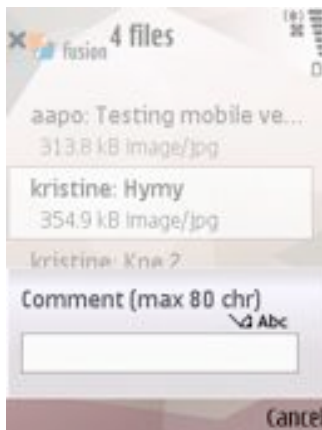


Figure 19 Comment Field

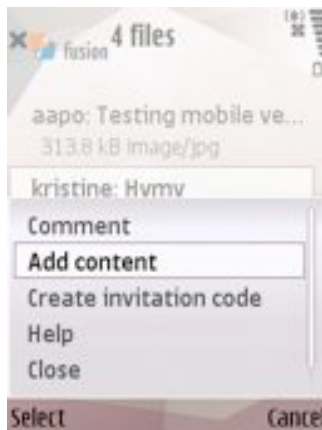


Figure 20 Add Content

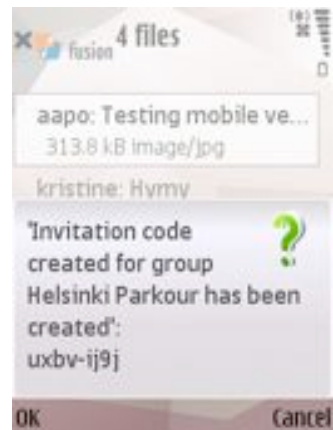


Figure 21 Invitation Code

Screenshots of the Parkour Test Prototype (continued)

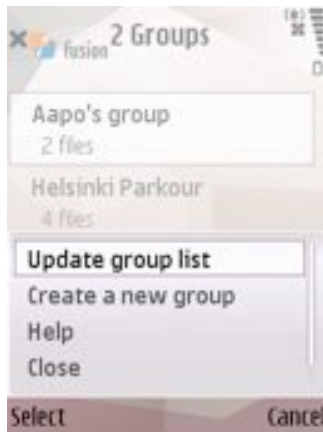


Figure 22 Update Group

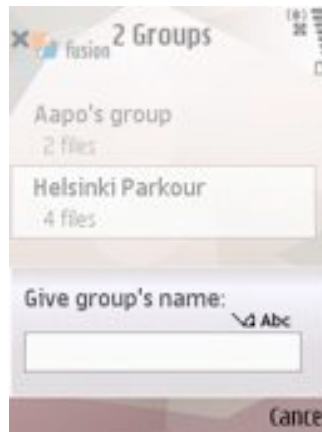


Figure 23 Create Group

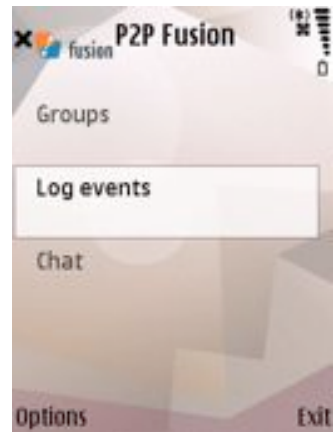


Figure 24 Log Events



Figure 25 List of Log Events

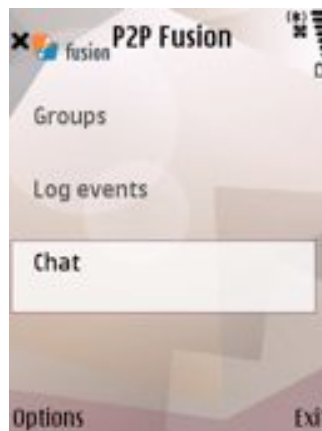


Figure 26 Chat



Figure 27 Chat Thread

Findings From the 1st Co-design Session

We immediately learned that one of the biggest problems with the first iteration of our design was that since Fusion Mobile did not support a camera application within the program itself, the first iteration included a version where users had to view both photos and videos using the mobile phone's camera application. This caused a great deal of confusion and cognitive overload since the Fusion logo was still visible above the mobile's camera application. Due to this, the user believed he was still in the Fusion Mobile application and became very confused as to why the menu options had suddenly changed without warning. The reason being, of course, that he had shifted unknowingly between two different applications with two different options menus.

Further, the action that the community member needed to undergo in order to complete the task of recording and uploading a video consisted of a large number of steps. It required 1) opening Fusion 2) opening the video application 3) taking a video 4) closing the video application 5) returning to Fusion 6) uploading the video 7) making sure the video uploaded successfully and so forth. The process was cumbersome and lacked fluidity. It was almost as if we were asking our user to speak two different languages at the same time, while typing something on a keyboard. The Parkour community member was not really sure why Fusion itself could not support taking of photos and videos with in the system and expressed a preference that either 1) all of the action could be contained in one system or 2) the distinction between the two systems would be made more clear. Realizing that this was something that could significantly affect all users, after our test session with the Parkour community, we implemented a number of changes to see if we could improve the system before our second round of testing. Specifically, a new type of photo viewing system within Fusion Mobile was implemented. We tested this change with the Mobile Developer community and the results are discussed in more detail in the following sections.

The iPod and iPhone May Have Raised and Changed Expectations

One especially interesting remark that we received from the Parkour community member was that as he was clicking through the menu for Fusion Mobile, he remarked casually: "I keep expecting this to work like the iPod." Apple's iPod, which is known for its hierarchical menus, allow users to select a menu item via a center clickwheel, and to select more or less detail with left and right clicks, respectively.

The memory of the way the menus for Fusion Mobile are organized in a hierarchical manner likely led the Parkour community member to keep trying to left and right click while choosing what he wanted to do. Unfortunately, left and right click was not available on our platform. Thus, the interaction became slightly frustrating for him. Even though we had not asked him to communicate or act using the language of Apple's iPod, he intuitively seemed to want to do so. While devices like the iPod, and more recently the iPhone, have been an undeniable boost to new

ways of thinking about user interface design and software applications (especially in terms of ease-of-use), they perhaps have also increased the expectations of users and, consciously or not, defined a new user interface language that many users may wish to use across many devices (regardless of the actual software platform that the system operates with). Of course, this problem is not unique to the Nokia N95 device, as any handset used in testing also affects the user experience of a mobile application. Further, we realized there was a limitation in not using the participant's own phones and asking them to use a mobile device that they might be unfamiliar with. This choice was made, however, to ensure a stable testing environment where we didn't have to try to troubleshoot problems across a wide variety of mobile devices.

The Balance Between Portability and Functionality

One of the main goals for this initial prototype was to allow the Parkour community to use Fusion on mobile devices in order to support the activity and outdoor-oriented lifestyle of their community. Since many of their events take place where bringing along expensive video equipment is either impossible or undesirable, it was important to them to be able to record and share videos without having to drag along a lot of cumbersome equipment.

However, one of the main drawbacks of Fusion Mobile was its intentionally limited set of features. For example, one important feature available on the desktop version of Fusion, annotation at a precise point in a video, was simply not available in the mobile version due to limitations with the Python technology that we had selected for our prototype.

The Parkour community member commented that he would like the ability to annotate video in the mobile version. Yet, even if technologically possible, adding a feature like this might significantly impact the performance speed of the prototype. So, which to choose: a technologically advanced prototype or one that is lean and has a rapid, reliable response? Of course, in this case our decision was made for us, since it simply was not technologically possible within the bounds of our coding language. But what to do in cases where a desirable feature is technologically possible, but may lead to unintended negative consequences (e.g draining of the battery)? In these types of cases we learned that mobile application developers must strike a balance between the following areas:

- feature bloat vs. feature scarcity
- robustness of application vs. negative, unintended technical consequences
- “cool” features vs. essential features
- stand-alone application vs. supplemental application

There does not seem to be one “right” method of determining which path to take. It seems that

there must be a continual dialog between communities and application developers in order to determine which path is best given these current circumstances, resources, and constraints. Features that may be considered essential for one community may be non-essential or hindrances to another.

3.2.5 2nd Co-design Session with the Mobile Application Developers

In the second test session, a group of Mobile Developers familiar with the P2P-FUSION project from a developer's workshop (arranged during fall 2008) tested our prototype. The objective of this test session was to allow a community of people who had previous experience with the Fusion desktop software to test the mobile version while thinking about their previous experience with the software. The structure of the co-design session was the same as with the Parkour community (see Table 3 Parkour Co-design Session Summary).



Figure 28 Detail of Mobile Developers Community Test Session

Again, the methodology used was a free exploration and discussion of the prototype. We had improved the prototype from the Parkour session, mainly by changing the way the images were viewed within the system by adding an internal Fusion Mobile viewer rather than using the built in viewer that came with the device. The Mobile Developers community performed the same tasks as the Parkour community including:

- creating a group
- joining a group
- viewing content
- commenting on content
- exploring content from other users
- chat

Mobile Device/Software	Nokia N95 mobile, one participant's own s60 mobile Fusion Mobile pre-installed
Set-up	Open meeting room
Documentation	Written notes, photos, video
Test Participants	3 male community members, ages approximately 30-40. Very familiar with mobile device programming languages.
Arki Members Present	Kristine Visanen (documentation) Aapo Rista (technical support & additional testing)

Table 5 Mobile Developers Co-design Test Session Details

Since this community featured users with a strong background in mobile technology, this session contained a more technical discussion of the prototype, and discussion of problems they saw with the user interface design, rather than a discussion of what their community would like to see in a prototype. This community also discussed bugs they found in the system. However, these bugs will not be discussed in this thesis as the goal of the test session was mainly to improve the user interface design and user experience of the prototype.

Screenshots of the Mobile Developers Test Prototype

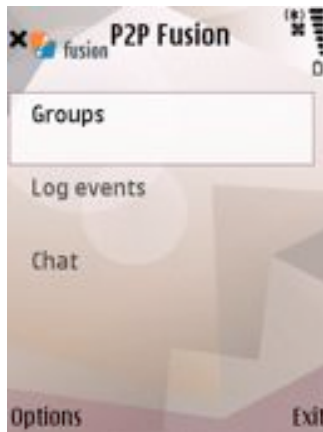


Figure 29 Task Options

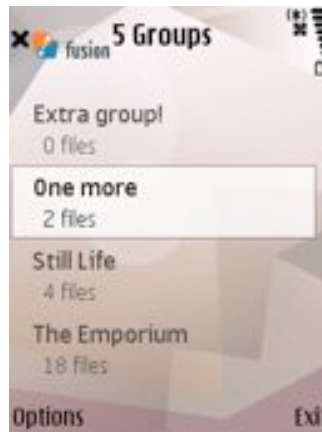


Figure 30 View Groups

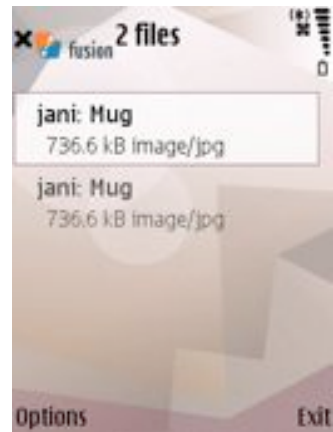


Figure 31 Select a File



Figure 32 New File Viewer



Figure 33 File Viewer Options



Figure 34 Comment

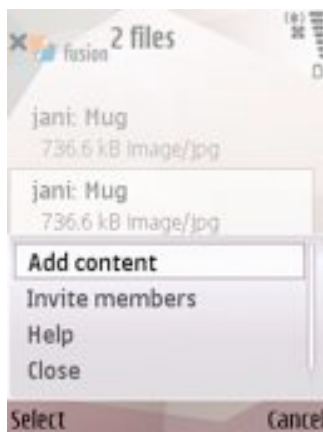


Figure 35 Add Content

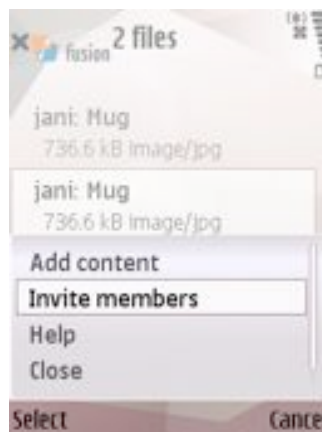


Figure 36 Invite Members

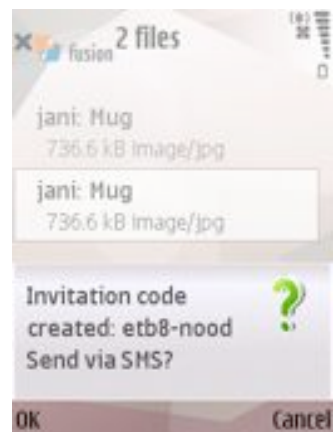


Figure 37 Send SMS

Screenshots of the Mobile Developers Test Prototype (continued)

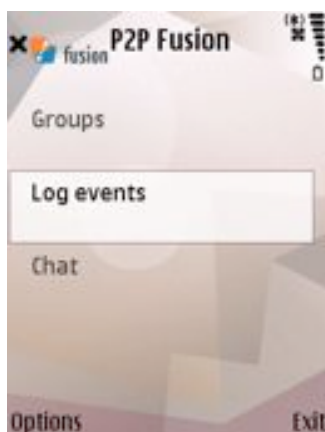


Figure 38 Log Events



Figure 39 Create Group

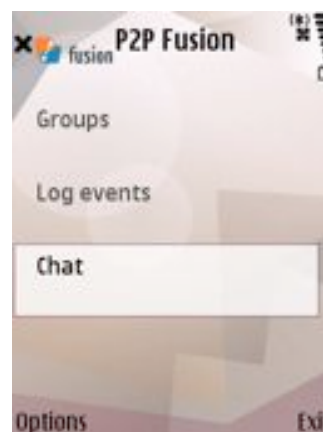


Figure 40 Chat



Figure 41 Chat Thread

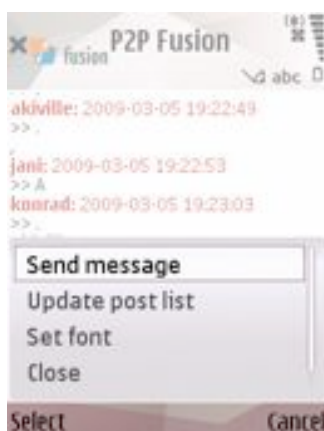


Figure 42 Send Message

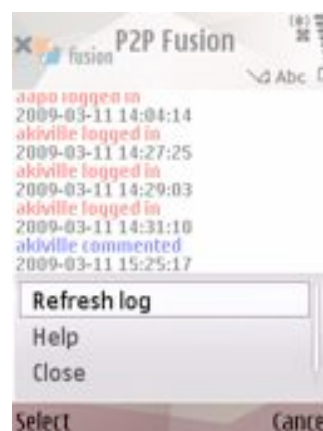


Figure 43 Refresh Log

Problems with the Second Version of the Prototype

After spending some time using features designed to connect users within the system, such as the “Chat” feature, the mobile developers community felt that it would be nice if the prototype had more of a “live” flow feeling, where a user could sense that their actions (and the actions of others) were happening in real-time.

The Mobile Developers community felt that notifications within the system are very important e.g. “John just posted a new comment on your video”, much like current social networking applications already do. They also felt that pop-up messages that gave an alert about events might be an effective way to do so. Additionally, their community felt that small additions like progress bars for file upload or download would be useful in giving the user feedback as to what is happening within the system.

In terms of ease of locating and viewing content, they expressed a desire for image thumbnails next to content lists, as well as limitations on video file sizes (less than 3MB) to prevent crashing the mobile device if too much information was sent. Of course, we had seen the need for image thumbnails early on, but were prevented from implementing them due to technological limitations. The Mobile Developers community also remarked that it would be useful to have a user list of who is using Fusion Mobile and what is happening at the current time (e.g. list of new videos). Again, this was something designed in the original wireframes, however, it had not been implemented due to limitations within our Python technology.

But if there was one interesting contrast to the general desire to add more information (e.g. image thumbnails), it was the concurrent desire to limit needless information. For example, it was universally agreed within the Mobile Developers community that the Chat feature contained far too many data items on the screen. One community member remarked that he wasn't interested in seeing the full date (e.g. 03-03-2009) every time he posted a message and that, in fact, he felt that approximately 60% of data on the screen was unnecessary.

Additionally, it was stated that with the current layout, 10 users or more online at the same time would likely cause parts of the application, like Chat, to be impossible to follow. It seems that in some ways, having an over-abundance of data severely limited community members as they got lost within the data. Ironically, a feature initially designed to connect community members, no longer was seen as very useful or helpful. This showed us that a technology that is designed to help people, but is poorly implemented, might do more harm than good.

Furthermore, the Mobile Developers community noted that when a delay in updating a content list or a comment that a user had posted occurred, it became a leading cause of user confusion and user errors. For example, one community member posted a comment, and then noticed that the comment thread still read "0 comments" a few moments later. He was confused as to whether or not he had actually made an error and whether or not he had actually submitted anything. But from our point of view, this concept of not always having automatic updates of data was on purpose. In our design, in order to minimize battery drainage, it was an intentional decision that the comment list would not refresh automatically. Thus, we unintentionally ended up with a prime example of the need to balance the robustness of application vs. negative, unintended technical consequences. It would be interesting research to find out if we had made the opposite decision, constant refreshing via the server, would users be bothered by the rapid battery drainage that the system caused?

Interoperability with Standard Mobile Phone Features

Like the Parkour community, the Mobile Developers community had an issue with the idea of

users having to initiate the use of the camera while using Fusion. Although there were several technical reasons (e.g. stability and reliability) why it was better during this stage of prototyping to use the original camera software application that came with the mobile device, it was repeatedly noted that most users do indeed have difficulty jumping back and forth between operating the camera and the Fusion software on the mobile device.

Further, the Mobile Developers community commented that another desirable standard feature to consider for the future would be the ability to export files from Fusion (e.g. using the pasteboard application, email, or MMS) and to save the information for later or to use it outside of the Fusion Mobile application. One community member remarked that he would like the option to save or export important information including content and comments from other users. Further, he wanted to have the ability to export entire threads of conversations from the Chat application. The community members agreed that the ability to have the same files available on the desktop version was a very useful feature, especially since the desktop version of Fusion currently does allow for exporting of content files.

Misleading Terminology

A number of the comments we collected during the user test session with the Mobile Developers community were geared towards what they felt was unclear or misleading terminology. Fusion Mobile contains a structure that mirrors the desktop version and organizes files by “Groups”. However, one community member pointed out that since there is currently no access control in the mobile version (e.g. all users of mobile devices are connected to the same P2P node), using the term “Group” is somewhat misleading. His suggestion was that in this case, the term “Channel” might be more appropriate to use with this type of technology. While this may seem like a small detail, it is important to note because it is a good example of how technology is not always seamlessly translatable across platforms. Sometimes, a term or concept does not translate well or sometimes it loses its original meaning when applied in a new manner. But with this in mind, the need for consistency across devices must also be maintained and users might become confused if “Groups” and “Channels” become the same concept, but with two different names on two different devices.

This terminology issue came up again when we reviewed our “Log Events” option. Log Events was originally designed to allow users of Fusion Mobile to see recent events that had occurred in the network (e.g. posting of a new file). However, the members of the Mobile Developers community pointed out that for average users the term “Log Events” might not be clear, or even relevant. It was suggested that perhaps it might even be best to remove this option from the main menu completely for average users and allow it as an option for advanced users. In the end, it was suggested that “Friends” would be a better name for the average user since most users

could better conceptualize that word. After this co-design session, although no additional changes were made to the prototype due to limited time, we realized that there is a great deal of work that needs to be done before Fusion Mobile can be tested with a wider audience.

4 Lessons Learned

4.1 Outcome of Community Involvement

Working with two very different communities, it was interesting to see how the feedback differed and how it stayed the same. Both communities had similar problems when it came to navigating the interaction between the prototype and the mobile phone's native camera application. However, the Mobile Developers seemed to have an easier time grasping the functionality of the system and what it was capable of. Perhaps it was because they were already familiar with the project, or perhaps because they had experience developing mobile applications, but testing with them seemed to be a good way for our software developer Aapo to develop ideas and to brainstorm new methods of allowing the technology to meet our needs. The Parkor community member, while familiar with the project, was not so deeply immersed in the technology. Further, the Mobile Developers were able to give concrete examples and elaborate on problems they experienced with the user interface, as they were familiar with mobile applications and their design. Perhaps since they shared somewhat of a common language with our software developer Aapo (in terms of software application design), they could tell us precisely where we had made mistakes in the user interface design instead remaining stuck on a problem and unable to proceed.

As a side note, in some ways this expanded understanding and appreciation of the Fusion Mobile technology by other mobile developers may be similar to how certain technically complex music often appeals to musicians (or people with a strong technical knowledge of music) since other musicians know how technically proficient one must be to play such a piece. Yet for an average listener, this type of "complicated" or technically advanced music is perhaps not in their taste since it is not easy to intuitively understand what it takes to make it work. Thus, it will be interesting to see if Fusion Mobile will become more greatly appreciated by people with a strong background in mobile development technology.

Mapping Out the Built-in Applications

Of course, looking back, one can always see what he or she would have done differently. In retrospect, I would have done the following differently regarding the user interface. Knowing that the leap from the Fusion application to the built-in applications for the mobile phone caused the largest amount of problems with our testers, I would have included that particular detailed interaction in the initial user interface wireframes as well. I am not sure if it would have helped fix

any of the problems to in advance, because it is likely it would have been glossed in the wireframes, but it may have shown us a potential trouble area earlier on. Regardless, I learned that even if a function is built in and “already taken care of”, in actuality it is not because it means that you must pay special attention to how that built-in action interacts with your own user interface. Pre-built user interface solutions may not save you any time as in the end as you must ensure that they do not serve to confuse users.

Work with Larger Number of People to Ensure a Larger Pool of Testers

Although the user communities for this project were chosen far before the mobile prototype was developed, working with small communities (e.g. 2 members) proved to be a somewhat risky option. It was extremely risky for me to only rely on one or two people from the original community to always be available for testing or to remain interested. If we had a larger community of 10 members, most likely I would have had an easier time recruiting test subjects for the Fusion Mobile prototype. Since I wanted to use the Parkour community as a test group because of their long-standing involvement with the project, I really had to put almost all my hopes on to a very small group of people. We were extremely fortunate, though, in that they were very helpful, reliable, and generous with their time and this did not turn out to be a problem. However, what to do in the case where it does become a problem and key community members are no longer available? This might be reason why profiling communities could be a good idea. Using profiles of community types, rather than specific communities might be an option if the project you have just spent years developing no longer has any interest from the community you initially worked with. In any case, it is worth thinking of a backup plan at the beginning of a project.

Thoughts on the Iterative Software Development Process

After interviewing our software developer Aapo Rista after the project, he stated that there were aspects with the project he was satisfied with, and aspects that could have been improved. For example, the method he used in the software development phase was an iterative process. By constantly making and then testing small parts of the application, he was able to incrementally improve the prototype and avoid a major set of revisions in the end. This seemed to work well in the timeline we had. However, since we had to work under such tight time constraints, his feeling was that although we had two good test sessions, we could have had more “development cycles” prior to test sessions in order to maximize the functionality of our prototype. When we discussed the test session further, his feeling was that while we received good community feedback from both communities, the second test session (Mobile Developers) was more useful to him personally since the larger group (3 members) offered more rapid feedback and were able to communicate with each other. Still, he suggested that regardless of community, a few more weeks for just prototype testing would have been highly productive.

In addition, Aapo felt it would have been useful to work on developing new code in weekly cycles, with smaller iterations over the week, ending the week with testing in a small group on a Thursday afternoon. Then, on Friday of the week, working on cleaning up the code and making plans for the following week and perhaps using a Wiki to organize the project. Additionally, he felt that us sitting together as a team, rather than across the room from each other, would have been a more effective iterative working method for this project.

Of course, unlike the desktop version of Fusion where there are multiple stakeholders in several different countries, in Fusion Mobile the only two people that worked together constantly were Aapo and myself. This had benefits in that we initially could make decisions quickly and easily, but caused problems when we showed our work to other members of our research group who had not been involved in the early decision making. Often, we had to explain why we did what we did when in our minds it was obvious. Of course, in retrospect it was only obvious to us. And members of our research group often had excellent suggestions for us to improve our work, which we should have made a better effort to implement earlier.

Future Development of the Prototype

We collected the results in textual and photographic form and made immediate improvements where we could. The specific data we collected regarding improvements or suggestions was then processed and ranked to see which improvements we could make with 1) our timeline and budget and 2) the limitations of our coding language (Python).

When I asked Aapo, our software developer, how we should proceed in terms of allowing this project to have the ability for future development (e.g. by independent developers), he stated that it would be crucial that we have a working test environment (downloadable packages) for the mobile client (a SIS-package to install in the phone), the web bridge and Fusion core modules, instructions to set up the whole system (including special technical requirements e.g. firewalls) and adequate documentation so an average programmer can see what happens in different parts of the application.

Since connectivity is currently an important topic within the Mobile Development community, the part of our project most relevant to other mobile developers would be the code that enables the web bridge technology: the Django interaction with a mobile phone.

In my opinion, I would be really happy if the prototype was able to take on a life of its own online. If users test and use it (especially in real-life settings as we were unable to mimic these in our test sessions), I am sure that a great deal of valuable feedback would be gained.

4.2 Final Thoughts

4.2.1 Did Mapping the 4C's into the Prototype Have an Impact?

In conclusion, as one of my research objectives was to investigate what would be a suitable framework for mobile application design that focuses on ubiquitous social networking, I created the 4C framework for the design process. While I cannot say with 100% certainty that outlining keys to a successful mobile prototype (in this case, the 4C's known as: constant contact, collaboration, community, co-design) changed the outcome of this project, I feel that the process itself of researching precisely what makes a successful prototype allowed me to keep a four-walled boundary for my thoughts and keep the project contained to a manageable level. Without any kind of structure, I feel that this prototype could have easily ballooned in scope to becoming a "junk drawer" application where all kind of random applications that have no relation to each other are thrown together in a metaphorical "junk drawer" in order to categorize and link unrelated functionality. By keeping the scope deliberately limited, I was able to ensure that each item had a definitive purpose. I feel that this lead to a more cohesive application that was easier to understand from the point of view of the users.

However, in contrast to this positive aspect, since I sketched out the user interface wireframes with these boundaries in mind, I was also limited by them. I spent hours writing the user interface documents, thinking I had perfected them, only to find out that when they were coded they were often no longer relevant. What made perfect sense on a piece of paper, often was 1) impossible to implement using Python or 2) impractical once we saw the actual code in action. By limiting myself to using the 4C's, I had unintentionally painted myself into a corner more than once where we were pressed for time and forced to make a rapid decision based upon what we saw when testing the prototype using the N95 phones, in order to avoid going back and re-writing all the user interface documents. If the initial boundaries I had made for myself were more flexible, perhaps I could have avoided trying to bend the project to fit my requirements as much as I did.

Designing Applications for Mobile Ubiquitous Social Networking

An important idea in terms of designing mobile applications for ubiquitous social networking is that it is crucial to consider the context of the environment that users will be using the prototype in, in real-life, as well as the ability to match that environment while testing. While we did get good overall feedback on our usability, we are still left with little idea about how this prototype functions outdoors, or with an unreliable Internet connection, or with different types of phones. A better situation might have been to have the users download the program from the Internet and install and connect it themselves to a WLAN network to see how they would function in a more realistic scenario.

Additionally, it is very helpful if users are familiar, or even use, the style of mobile devices provided for the testing beforehand. While this may seem like an obvious concept, it is sometimes underemphasized just how much users rely on how they have personalized their own phones to work. When asked to switch to a phone that is similar, but not exactly the same as their own, there is a learning curve for the new mobile device that impacts the testing as well as the feedback received.

4.2.2 Developing Co-design Working Methods with Communities

As far as my second research objective, which asked how communities inform and contribute to the design process when designing ubiquitous social networking applications for mobile devices via a co-design methodology, the results were that one must remain focused on the co-design methodology they have chosen. In my opinion, it can be easy for a practitioner of co-design to slip away from a co-design methodology and begin designing products on their own (without help from communities) if pressured for time or a certain result. For example, if time is running out, and no one from the community is available, it would tempt almost any practitioner of co-design to go ahead without the community. And in some cases, this might be effective and acceptable. If the entire project is being held up by one community, does it not make sense to make some small, seemingly insignificant decisions without them? But if this keeps happening, it is worth exploring whether or not co-design is really the best working method for the project. Perhaps co-design projects are best suited for less time-sensitive projects or projects where communities have almost unlimited time to devote. This might be one reason why the Fusion developers workshop for the desktop version held in fall 2008 with the Mobile Developers was a success: because they were there for an entire weekend with no other distractions to prevent them from completing the task at hand. It might be that short, intense, uninterrupted blocks of time are the best option when considering how to organize and manage co-design sessions. Too much time away and communities may tend to lose focus and interest.

Is Designing for Community Profiles an Option?

After gaining specific insights from the original co-design session with the Parkour community, I began to think more deeply about a prototype that could be used by a profile of any real-life community that wanted to share files in a private space, without being tied to a desktop computer. One problem that I felt had a good probability of occurring during a long-term project such as this was that a user community might drop out of our project at any time. If this were to be the case, then what would happen if we developed a prototype for a specific community who, in the end, was no longer available? I began thinking about whether profiling a community type was an appropriate solution to this problem of keeping communities interested in the long run.

Of course, almost immediately after I began thinking about this profiling idea I wondered if this

thesis was beginning to shift away from the true principles of co-design. Clearly, one problem with co-design is keeping a group of test users motivated and engaged throughout the process. But how to do so when the process takes several years? It perhaps might be unrealistic in many circumstances to expect a community to stay interested in a project for so long, especially considering that life circumstances often change from year to year. Perhaps, then, it can be a viable option to design for community profile types in order to ensure that work is not done in vain and can continue even if the original community is no longer able to participate. As Michael Muller points out when discussing the benefits of co-design or participatory design in his paper *Participatory Design: The Third Space in HCI*: "... This in-between domain, or third space, is a good place to look for new insights and understandings, and for syntheses of diverse knowledges into ideas for products and work practices..." (Muller 2007, p.1) If we follow this line of reasoning, maybe these "in-between" areas occur also between different communities who share similar profiles (e.g. people that like to do things outdoors). If this is the case, maybe community profiles can give new insights and ideas with regard to the practice of co-design over the long-term. With that in mind, I tried to keep my scenarios relating not only to specific communities, but also to types of communities.

The Changing Role of Designers & Communities

I felt the testing process showed that if users become heavily involved in the design process, in some respects, the role of a designer changes from creative problem solver to creative facilitator of communication, or even a project manager. I felt that my role changed from being one tasked with generating original, new ideas, to one that worked to engage others in the process and, in a way, manage the process of design rather than do any actual design. During the user test sessions, I spent my time helping the users if they got stuck while trying to complete a task, or asking them to articulate their thoughts when they looked puzzled or confused. And during our re-design sessions, I spent a lot of time collaborating with our software developer Aapo to see if we could translate the communities needs into concrete tools or actions in our prototype. Of course, this experience is not new or unique to this only thesis. Most practitioners engaged in the practice of co-design have likely experienced this phenomenon for themselves.

However, what is more useful in terms of the changing role of designers related to this particular thesis is the idea that working with communities on any level holds a new set of challenges that a practitioner of co-design might not necessarily envision. For example, the ebbing and flowing of community involvement as mentioned earlier in this section is one aspect to keep in mind. Additionally, what happens if (as did with this project) some of the most valuable feedback received is from a community that joined during the last 10% of the project? Does it mean that the initial community that was picked was not the best suited? Or it more that as the project goes on, needs and requirements also tend to ebb and flow and that what worked in the beginning

might not work as well in the end? In my opinion, since there are human factors at work in all aspects of working with communities, it is not possible for community requirements (needed by them and from them) to always remain constant. A practitioner must be sensitive to these changing boundaries within relationships with the communities and must make room for these types of shift within the project.

Finally, like most other thesis works, this project could have been developed and improved indefinitely. I hope that any reader of this thesis work is able to see what I have written as a brief snapshot in time where I have documented the process and progress as it once stood. Further, I hope that any reader has enjoyed reading it as much as I have enjoyed writing it.

5 References

- Arjan, R., Pfeil, U., and Zaphiris, P. (2008). Age Differences in Online Social Networking. *CHI '08 Extended Abstracts on Human Factors in Computing Systems (Florence, Italy, April 05 - 10, 2008)*. ACM, 2739-2744.
- Botero Cabrera, A., Kommonen, K.H., Oilinki, I. and Koskijoki, M. Codesigning Visions, Uses, and Applications. *Proc. of "TechnE Design Wisdom" 5th European Academy of Design Conference*.
- Boyd, D. M. and Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*. 13 (1), 11.
- Boyd, D. (2007). Why Youth (Heart) Social Network Sites: The Role of Networked Publics in Teenage Social Life. *MacArthur Foundation Series on Digital Learning – Youth, Identity, and Digital Media Volume (ed. David Buckingham)*. 1.
- Bradwell, P., Hannon, C., and Tims, C. (2008). *Video Republic*. Demos. Available: <http://www.demos.co.uk/publications/videorepublic>. Last accessed 15 Dec 2008.
- Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. New York: H B S P.
- Coyle, C. and Vaughn, H. (2008). Social Networking: Communication Revolution or Evolution? *Bell Labs Technical Journal*. 13 (13), 1
- Greenfield, A. (2006). *Everyware: The Dawning Age of Ubiquitous Computing*. Grand Rapids: New Riders.
- Haddon, L. (2008). *Mobile Access to Social Networking Sites: A UK Survey, a Report for Vodafone*. London School of Economics. Available: <http://www.lse.ac.uk/collections/media@lse>. Last accessed 16 Oct. 2008.
- Jones, M., and Marsden, G. (2006). *Mobile Interaction Design*. New York: John Wiley & Sons, Inc.
- Kirkpatrick, M.. (2008). *Corporate Social Networks Are A Waste of Money, Study Finds.* Read Write Web. Available: <http://www.readwriteweb.com>. Last accessed 16 Oct. 2008.
- Kjeldskov J. and Howard S. (2004). *Envisioning Mobile Information Services: Combining User-*

and Technology-Centered Design. *Proceedings of the 6th Asia-Pacific Conference on Human-Computer Interaction, APCHI 2004, Rotorua, New Zealand*. 1 (1), 180-190.

Li, C. (2008). *The Future of Social Networks: Social Networks Will be like Air*. Forrester Research. Available: <http://blogs.forrester.com/groundswell/2008/03/the-future-of-s.html>. Last accessed 06 June 2008.

Li, C., and Bernoff, J. (2008). *Groundswell : Winning in a World Transformed by Social Technologies*. New York: H B S P.

Lindholm, C., Keinonen, T., and Kiljander, H. (2003). *Mobile Usability: How Nokia Changed the Face of the Mobile Phone*. New York: McGraw-Hill Education.

Mattelmäki, T. (2005). *Design Probes. (Dissertation)*. Helsinki: The University of Art and Design.

Muller, M.J. (2007). Participatory Design: The Third Space in HCI. In J. Jacko and A. Sears (eds.), *Handbook of HC*.

Murphy, J., Kjeldskov, J., Howard, S., Shanks, G., and Hartnell-Young, E.. (2005). The converged appliance: "I love it...but I hate it". *Proceedings of the 17th Australia Conference on Computer-Human interaction: Citizens online: Considerations For Today and the Future (Canberra, Australia, November 21 - 25, 2005)*. 122 (3), 1-10.

Norman, D. A. (2003). *Emotional Design : Why We Love (or Hate) Everyday Things*. New York: Basic Civitas Books.

Norman, D. A. (1998). *The Invisible Computer : Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution*. New York: MIT Press.

P2P-FUSION Consortium. (2006). Description of Work. Helsinki, Finland.

P2P-FUSION Consortium (2007). State of The Art in Social Processing. Budapest, Hungary.

Rheingold, H. (2002). *Smart Mobs: The Next Social Revolution*. Cambridge, MA: Perseus Pub.

Rivlin, G. (2008). *Wallflower at the Web Party*. The New York Times. Available: <http://www.nytimes.com/2006/10/15/business/yourmoney/15friend.html>. Last accessed 16 Oct. 2008.

Sanders, E. B., and Stappers, P.J. (2008). Co-creation and the New Landscapes of Design. *CoDesign*. 4, 5-18.

Savio, N., and Braierman J. (2007). *Design Sketch: The Context of Mobile Interaction.*” *International Journal of Mobile Marketing*. Available:
http://www.giantant.com/output/mobile_context_model.pdf. Last accessed 12 Dec. 2008.

Thompson, C. (2008). *Brave New World of Digital Intimacy*. The New York Times. Available:
<http://www.nytimes.com/2008/09/07/magazine/07awareness-t.html>. Last accessed 16 Oct. 2008.

Toivonen, S. (2007). *Web on the Move: Landscapes of Social Media*. VTT Technical Research Centre of Finland. Available: <http://www.vtt.fi/inf/pdf/tiedotteet/2007/T2403.pdf>. Last accessed 01 Nov. 2008.

Visanen, K. (2008). *Co-design for the Global Economy (Unpublished Academic Writing Coursework)*. Visanen.com. Available: http://visanen.com/wordpress/wp-content/uploads/2008/07/kv_final1.pdf. Last accessed 01 May 2008.

Von Hippel, E. (2005). *Democratizing Innovation*. New York: MIT Press.

Weiser, M. (1993). Some Computer Science Issues in Ubiquitous Computing. *ACM*. 36 (7), 75-84.

Weiser, M. (1999). The Computer for the 21st Century. *SIGMOBILE Mob. Comput. Commun. Rev.* 3 (3), 3-11.

6 Appendices

6.1 Screenshots of the Fusion Desktop Application

The desktop version of the Fusion application enables users to share audiovisual media (and other files) in private groups via a peer-to-peer (P2P) network.

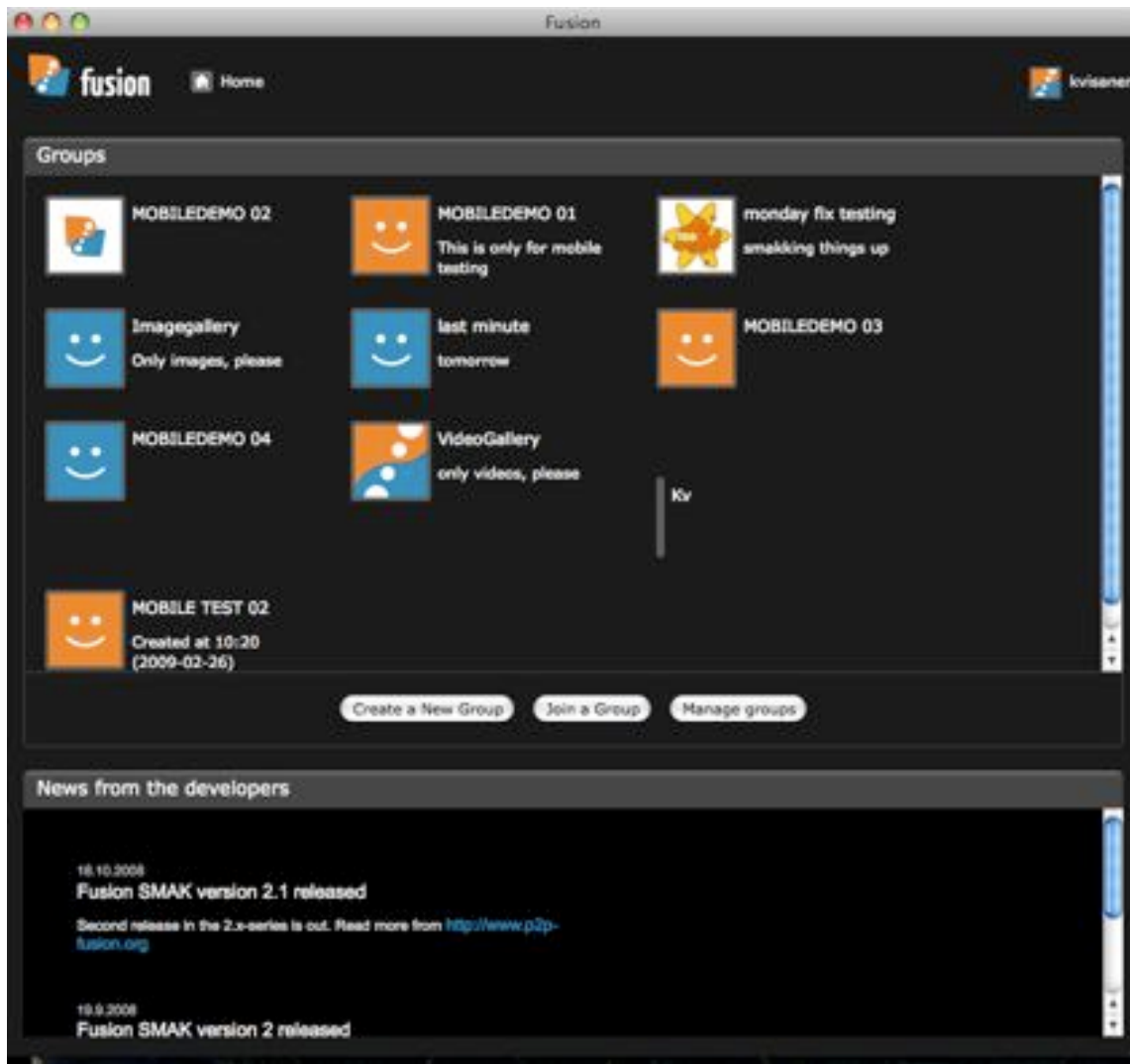


Figure 44 Groups Page on the Desktop

The shows main page of the desktop version of the Fusion application prototype (Version 3, alpha). The top part of the page displays the user's "Groups" in which (s)he can share audiovisual media files with other group members.

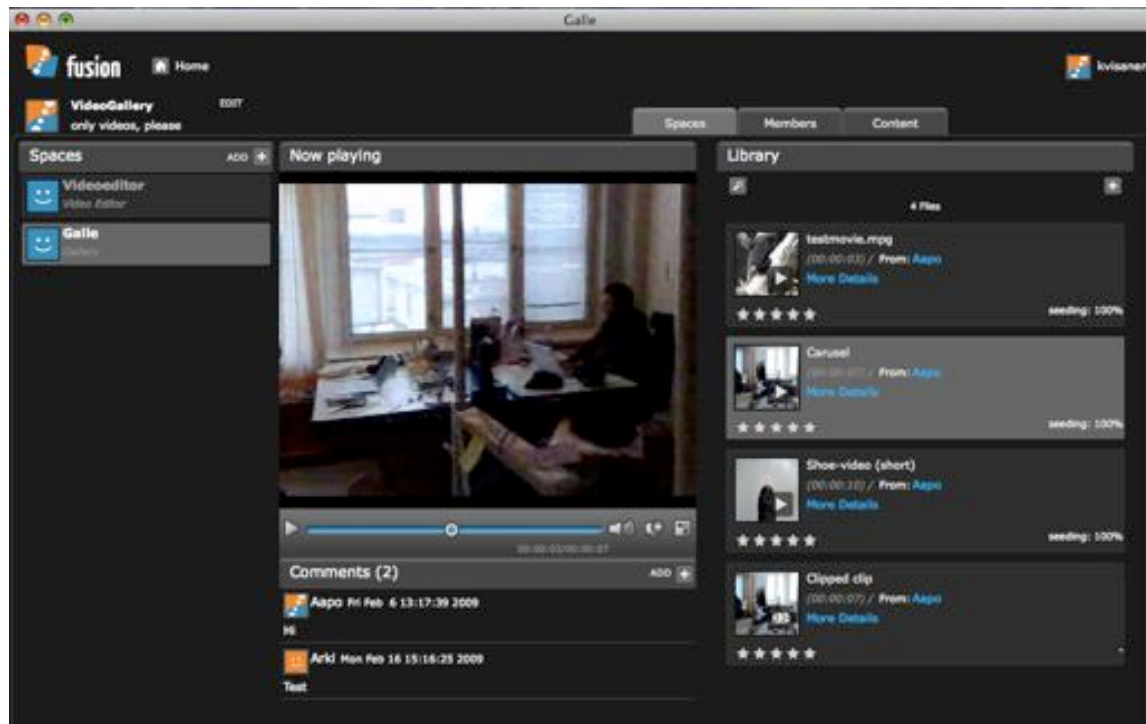


Figure 45 Content Listing with Video Player on Desktop

This screen shows the Group page that can be accessed from the main page. In this page, group members can share audiovisual media. Media files shown in the "Library" (on the right) can be played, commented on, rated etc.

6.2 Summary of Features Desired by the Parkour Community

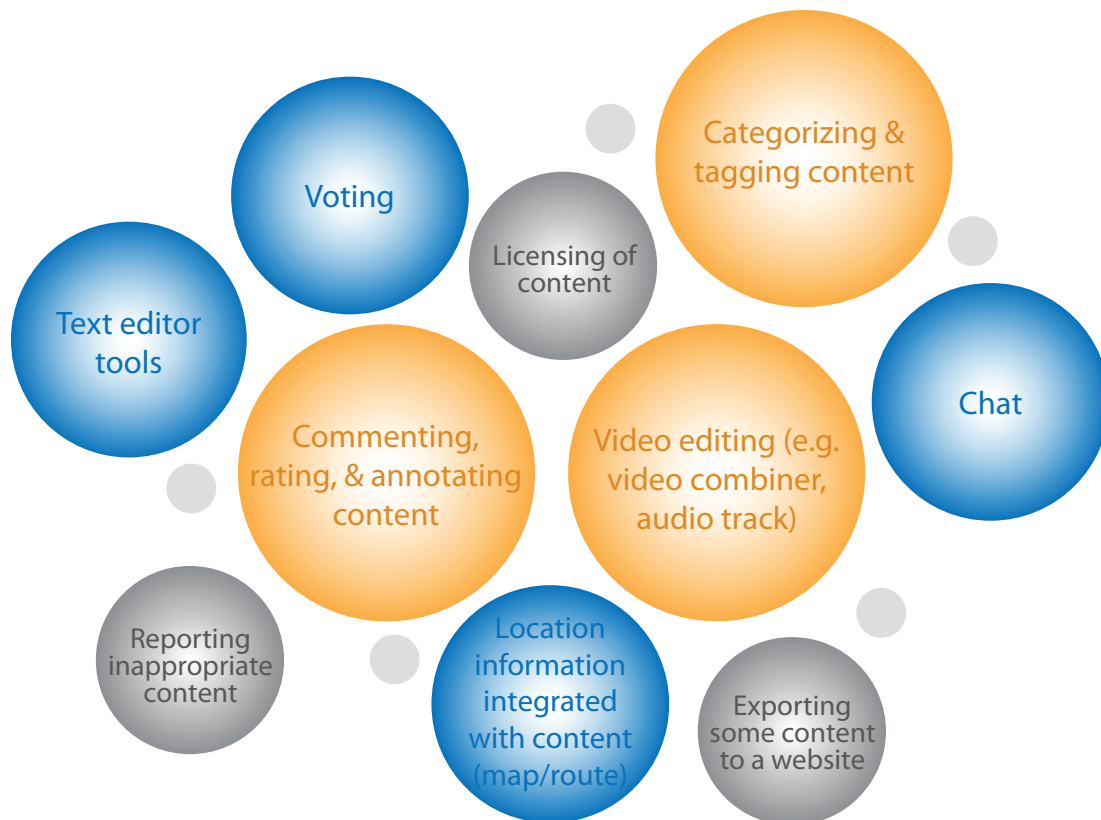
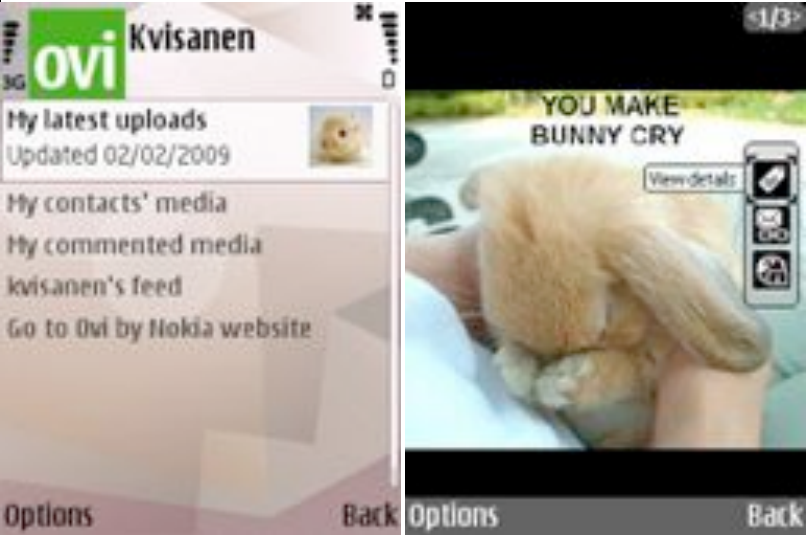


Figure 46 Summary of the Enriching Features that the Parkour Community would like to have in a Fusion Mobile Application. Larger circles indicate greater priority.

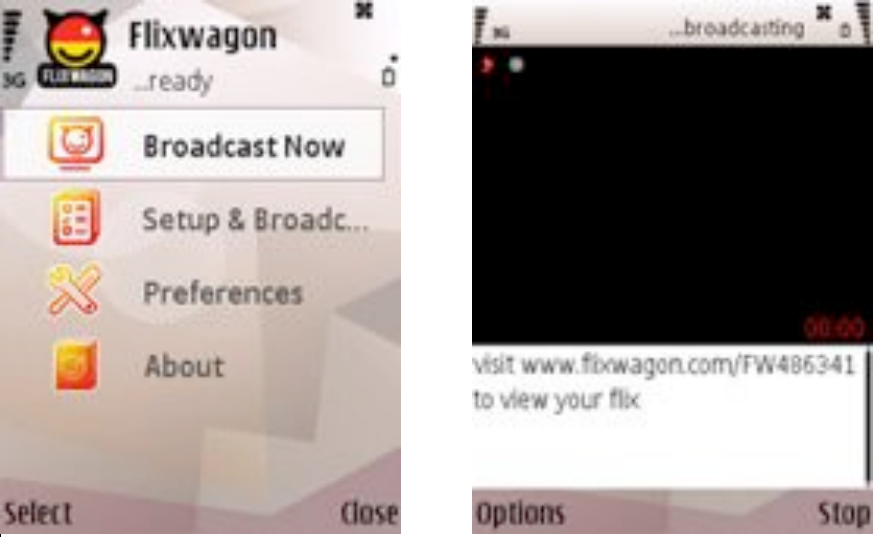
The Parkour community would like to share and creatively reuse videos (as videos are generally important in the context of Parkour for learning tricks/moves). Some videos are currently distributed via the Finnish Parkour Association's website, but shared videos are often on a public service website (e.g. YouTube), which is not optimal for in-community sharing. Having a way to comment, rate and annotate videos privately among community members would be preferable.


6.3 Benchmarking Study

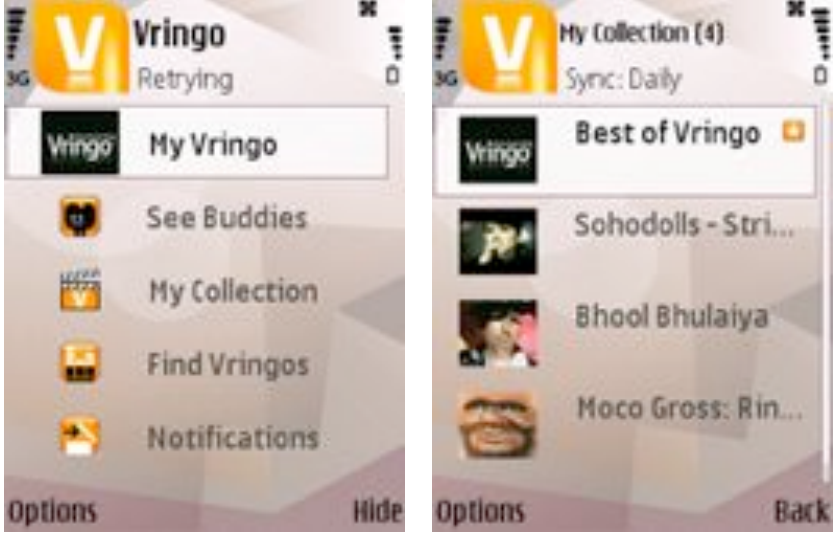
<p>Nokia Ovi ovi.com</p>	
<p>Description</p>	<p>View, download and send files stored on your PC right on your mobile. Keep your contacts & calendar up to date, in sync and backed up on Ovi. Now sharing a moment is as easy as capturing it. Photos no longer get stuck in your device with Share on Ovi. Free and unlimited storage from Share on Ovi means you can manage all your personal media in one place. Access it from your mobile device, PC or Mac. One-to-one or loud and proud - share your media your way. Keep it private with one person, a group, or go public with the world. (Source: ovi.com)</p>
	<p>Ubiquitous social networking component: Public/private sharing of media (e.g. videos, photos) among a social network</p>
<p>Floobs floobs.com</p>	


Description	<p>“Stream live video from a mobile phone, web camera or video camera to your channel on Floobs, Facebook or MySpace.” Floobs is an internet service offering tools for creating and distributing one’s own TV Channel anywhere in the world. All that is needed for live broadcasting is a video-enabled mobile phone (during spring 2008) or a computer with a webcam. Floobs API is a JavaScript Object Notation (JSON) API that works on top of HTTP (Source: floobs.com). Note: unclear if they are still supporting the mobile version.</p> <p>Ubiquitous social networking component: The live video streaming allows a user to share videos real-time with their network.</p>
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Qik qik.com	
Description	<p>Mobile Live Video Sharing for Everyone, Everywhere! With Qik, you can share with anyone and everyone what’s going on anywhere and everywhere you go. Qik’s focus is on developing the perfect mobile video platform, providing the highest quality of live video experience across all devices and networks. (Source: Qik.com)</p> <p>Ubiquitous social networking component: Sharing of live video content with your friends.</p>

<p>FlixWagon flixwagon.com</p>	
<p>Description</p>	<p>Broadcast live video from your mobile phone. At Flixwagon, our vision is to bring innovation into the way people connect to each other and share their experiences. With Flixwagon you can broadcast your life LIVE! Currently Symbian but working on developing for Java, Windows Mobile, and the iPhone. (Source: Flixwagon.com)</p> <p>Ubiquitous social networking component: Allows for live streaming of content filmed from a mobile phone camera.</p>


<p>Kyte kyte.com</p>	
<p>Description</p>	<p>Kyte provides powerful mobile production and distribution capabilities, enabling you to engage more often and in multiple ways with your audience, even when they're on the go. With Kyte's mobile capabilities you can produce authentic, live or on-demand content, delivered in real-time to both Internet and mobile audiences, allowing you to build community, brand affiliation and loyalty through interactive, online and mobile audience participation. The Kyte mobile application is for J2ME.(Source: Kyte.com)</p> <p>Ubiquitous social networking component: Sharing of live and on demand content</p>

<p>Vringo vringo.com</p>	
<p>Description</p>	<p>Vringo is a video sharing community that allows you to find and create video ringtones (or Vringos) and then share them with your friends -- all on your phone. You choose the clips you'd like your friends to see and they choose the clips they'd like you to see. Vringo clips are from the best of movies, TV and music, or created by you, either online or on your phone. Upload video's and send your friends the latest thing going on with you by sharing a video --- all on your mobile phone! Java based. (Source: Vringo.com)</p> <p>Ubiquitous social networking component: Allows for media sharing with your social network</p>

<p>Zannel zannel.com</p>	
<p>Description</p>	<p>[Zannel is] Twitter with multimedia. Take your video-picture, email it to your Zannel account, add some text to the body of the email and wham instant Zannel post in one minute or less. Allows people to instantly and visually communicate what's happening now across mobile and the web, including all major social networks. Mobile web interface optimized for iPhone. (Source: Zannel.com)</p> <p>Ubiquitous social networking component: Integrates easily with social networking sites.</p>

<p>Livecast livecast.com</p>	
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Description	<p>Livecast offers a simple, convenient, option for capturing and sharing events, while eliminating the delay, hassle and expense of uploading videos through wireless MMS or a PC. Instead, Livecast has automated the process of webcasting, and concurrently saving videos on a web-server, ready to publish to online communities, video sharing sites and blogs with one-button simplicity. Works for Windows Mobile 5/6 and Symbian S60 phones. (Source: Livecast.com)</p> <p>Ubiquitous social networking component: Live sharing of events.</p>

<p>Shozu shozu.com</p>	
Description	<p>Upload Anywhere, Any Time. ShoZu means you can share the moment, be it photos or video or a blog. You can send your stuff to friends and family, email or social networks as simply as pressing the button. Download the ShoZu application on your handset for access to all the great ShoZu features-such as one-click uploads to your favourite sites and emails, downloads, and the ability to read and reply to friends' feeds and status updates. (Source: Shozu.com).</p> <p>Ubiquitous social networking component: One click to add media to various SNS sites. Since the application makes distribution of files more easy, users are more likely to share amongst at larger network or group of sites.</p>

6.4 Glossary

Everyware

Adam Greenfield defines it as “...a coherent paradigm of interaction via ubiquitous information technology that includes: ubiquitous computing, pervasive computing, physical computing, and tangible media....”

Media Sharing

The practice of sharing content between groups of users. Often involves re-mixing and reusing content from other sources.

Peer-to-Peer File Sharing

In order to understand the P2P-FUSION project, it is important to understand the concept of Peer-to-Peer (P2P) file sharing. P2P file sharing is defined as:

“...a computer network [that] uses diverse connectivity between participants in a network and the cumulative bandwidth of network participants rather than conventional centralized resources where a relatively low number of servers provide the core value to a service or application. P2P networks are typically used for connecting nodes via largely ad hoc connections. Such networks are useful for many purposes. Sharing content files containing audio, video, data or anything in digital format is very common, and real time data, such as telephony traffic, is also passed using P2P technology.” (Wikipedia)

For simplicity, this concept is visualized in the graphics below.



Figure 47 P2P Network With Some Nodes Off



Figure 48 P2P Network On

In Figure 47, only some nodes of the network are off, thus, the media files are transferred between only the active nodes. In Figure 48, all participating nodes are active - when these nodes are "turned on" (connected), the files in formerly only on the three active nodes are also now transferred to the three new nodes. In a P2P network a computer (or mobile device) can function as a participant in a selected network with any other computer (or mobile device) and share and distribute files easily within that network. Rather than connect with only one server that distributes all of the files, a P2P connection allows a user to connect to any number of specific devices that host the files within a chosen network. This allows not only for potentially faster access, but also increased security in that files only exist within a certain network and not all over the Internet. Of course, that security only exists if everyone in the network is trusted.

P2P's Shadowy Past

As most people interested in P2P file sharing technology are aware, P2P file sharing received a great deal of bad press around the year 2000 due to its association with file sharing sites like Napster which shared copyrighted files indiscriminately. More recently, the Swedish website The Pirate Bay (which uses P2P bit-torrent technology to share files) has been subject to a number of lawsuits in an effort to determine its legality. Thus, we can see that P2P did not die out with the demise of Napster, but has continued to grow and evolve and is now in its fourth generation. The most well known applications for this generation include P2P applications for sharing and streaming television and video over P2P networks.

Future applications for P2P that are currently being developed or appear to hold promise for future research include:

- Skype (P2P Telephony using VOIP technology)

- Academic Search Engines (Sciencenet)
- Television (Miro)

This is by no means an exhaustive list and shows only a few recent applications of P2P technology.

Social Enrichment

Social enrichment features are an important part of the P2P-FUSION project and can be defined as “...mechanisms such as annotating, recommending, rating, ranking, translation, reviewing, and compilation into collections...” (P2P-FUSION Consortium 2006, p.10). They are tools that enhance and allow users to find content that is relevant to them based on recommendations from other users. (P2P-FUSION Consortium 2006, p.24) As discussed in this thesis, the project partners we worked with in Hungary created a very thorough and in-depth review of which types communities need which types of social processing features.

Social Media

When defined within the P2P-FUSION context “...mechanisms such as annotating, recommending, rating, ranking, translation, reviewing, and compilation into collections...”

Social Network

A configuration of people connected to one another through interpersonal means, such as friendship, common interests, or ideas

Social Networking

The use of a specific type of Web site focused on the creation and growth of online social networks which allows users to interact

Ubiquitous Computing

Mark Weiser, the founding father of this concept, defined it as: 1) the purpose of a computer is to help you do something else; 2) the best computer is a quiet, invisible servant; 3) the more you can do by intuition the smarter you are; the computer should extend your unconscious; and finally that 4) technology should create calm.

6.5 Functional Requirements Documentation

Functional requirements define the actions that the application should be able to perform (i.e. What does the application do?).

Account Login	
Requirement name:	Account Login
ID:	AccountLogin
Description:	The application should allow users to login to their Fusion account via mobile phone and see the groups of which they are a member.
Impact:	MUST HAVE
Dependencies:	

Record Video	
Requirement name:	Record Video
ID:	RecordVideo
Description:	The application should allow users to record video via mobile phone.
Impact:	MUST HAVE
Dependencies:	

Play Video	
Requirement name:	Play Video
ID:	PlayVideo
Description:	The application should have the ability to allow a user to play a video on their mobile phone.
Impact:	MUST HAVE
Dependencies:	

View Other Video	
Requirement name:	View Other Video
ID:	ViewOtherVideo
Description:	The application should have the ability to allow two users to see each other's videos in a closed community.
Impact:	MUST HAVE
Dependencies:	

Browse Groups	
Requirement name:	Browse Groups
ID:	BrowseGroups
Description:	The application should have the ability to allow the user browse group names of which he/she is a member.
Impact:	MUST HAVE
Dependencies:	

Browse content in a group	
Requirement name:	Browse content in a group
ID:	BrowseContentGroup
Description:	The application should have the ability to allow the user to browse content in a group.
Impact:	MUST HAVE
Dependencies:	JoinAGroup

Annotate content in a space	
Requirement name:	Annotate content in a space
ID:	AnnotateContent
Description:	The application should have the ability to allow the user to comment on content in a space.
Impact:	MUST HAVE
Dependencies:	JoinAGroup, BrowseContent

Adding a group or space	
Requirement name:	Adding a group or a space
ID:	AddGroup
Description:	The application should have the ability to allow the user to add a group or a space.
Impact:	MUST HAVE
Dependencies:	JoinAGroup, BrowseContent

See that a space has been updated

Requirement name:	See that a space has been updated
ID:	SeeUpdate
Description:	The application should have the ability for the user to reload the group when one of their spaces has been updated.
Impact:	MUST HAVE
Dependencies:	

Non-functional Requirements

Non-functional requirements are usually related to various quality issues, such as: speed and response times (should start up very quickly), usability (application should clearly inform the user about the status), and capacity (e.g. data storage needs).

Speed of Application	
Requirement name:	Speed of Application
ID:	SpeedOfApp-NONF
Description:	The application needs a quick response time.
Impact:	MUST HAVE
Dependencies:	Speed of server, type of mobile, the speed and response time of mobile network connection, the speed of lower level layers in P2P Fusion.

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Usability	
Requirement name:	Usability of Application
ID:	UsabilityOfApp-NONF
Description:	The application needs to inform the user after every step about what is happening.
Impact:	MUST HAVE
Dependencies:	

Capacity	
Requirement name:	Capacity of Application
ID:	CapacityOfApp-NONF
Description:	The application needs to have enough data storage space to view videos that are under 5 minutes.
Impact:	MUST HAVE
Dependencies:	Depends on power of the phone

Mobile Platform	
Requirement name:	MobilePlatform
ID:	The application should work on a Nokia s60 mobile phone.
Description:	The application needs to have enough data storage space to view videos that are under 5 minutes.
Impact:	MUST HAVE
Dependencies:	These are the types of phones available to us in Media Lab for testing.

Interface Requirements	
Requirement name:	UI Requirements
ID:	UI Requirements
Description:	A detailed list of UI requirements is provided separately.
Impact:	MUST HAVE
Dependencies:	Please see the related UI documentation.

See that a space has been updated	
Requirement name:	See that a space has been updated
ID:	SeeUpdate
Description:	The application should have the ability for the user to reload the group when one of their spaces has been updated.
Impact:	MUST HAVE
Dependencies:	

6.6 Use Case Scenarios

Use Case # Account Login	
Actor	Any
Preconditions	User has a working internet connection.
Trigger	User has decided to use the P2P-FUSION Mobile Application on his/her phone
Step sequence	1: User selects the P2P-FUSION Mobile Application 2: The user is promoted to enter his/her account information. 3: The user enters his/her login info (saved after the first session). 4: The user presses enter to log in to the application. 5: The user is logged in.
Extensions	1a: The user decides to cancel the login. 1a1: The user selects cancel. 1a2: The user returns to the main application chooser. 1b: The user enters the wrong user ID or password. 1b1: The user receives an error message stating the problem. 1b2: The user re-enters the correct information. 1b3: The user presses enter to log in to the application. 1b4: The user is logged in. 1c: The user enters the wrong user ID or password. 1c1: The user receives an error message stating the problem. 1c2: The user decides that he/she requires assistance. 1c3: The user presses help for assistance. 1c4: The user sees a help screen 1c5: The user reads the screen and then presses exit to return to the main login screen.

Use Case # Browse groups	
Actor	Any
Preconditions	User has a working internet connection and has successfully logged in to the application.
Trigger	The user has decided to use the P2P-FUSION Mobile to browse content within groups that he/she is a member of.
Step sequence	1: The user has successfully logged in to P2P-FUSION Mobile. 2: The user sees a list of groups that he/she belongs to, fetched automatically after login . 3: The user scrolls through the list and selects a group. 4: The user presses "Select" to choose a specific group. 5: The user is entered to the private area for that particular group.
Extensions	1a: The user decides to cancel the viewing of groups. 1a1: The user selects exit. 1a2: The user is asked if he/she wants to log out of P2P-FUSION Mobile. 1a3: If the user selects "Yes", he/she is logged out of the application. 1a4: If the user selects "No", he/she is returned to the main group selection page

Use Case # Browse content in a group	
Actor	Any
Preconditions	The user has a working internet connection and has successfully logged in to the application. The user has selected the group that he/she would

	like to view.
Trigger	The user has entered a specific group.
Step sequence	<p>1: The user has successfully logged in to P2P-FUSION Mobile.</p> <p>2: The user sees a list of groups that he/she belongs to and has selected a group to enter.</p> <p>3: The user has entered the group and sees the list of content with small icons associated with the group.</p> <p>4: The user selects a video from the list and decides to view it.</p> <p>5: The user selects “Play” and the video begins to play on the user’s mobile. The video player is a separate application “Real Player”.</p> <p>6: The video ends and the user is returned to the same content screen from which they selected the video.</p>
Extensions	<p>1a: The user decides to cancel the viewing of a group video.</p> <p>1a1: The user selects exit.</p> <p>1a2: The user is returned to the group’s content list.</p> <p>1b: The user decides to cancel the viewing of a group’s video and exit the group.</p> <p>1b1: The user selects exit.</p> <p>1b2: The user is returned to the group’s content list.</p> <p>1b3: The user selects exit again.</p> <p>1b4: The user is asked if he/she wants to log out of P2P-FUSION Mobile.</p>

Annotate content within a space	
Actor	Any
Preconditions	The user has a working internet connection and has successfully logged

	in to the application. The user has selected the group that he/she would like to view. The user has selected a video. The user is watching that video.
Trigger	The user has decided to comment on a video that he/she is viewing.
Step sequence	<p>1: The user has successfully logged in to P2P-FUSION Mobile.</p> <p>2: The user sees a list of groups that he/she belongs to and has selected a group to enter.</p> <p>3: The user has entered the group and sees the list of content associated with the group.</p> <p>4: The user selects a video from the list and decides to view it.</p> <p>5: The user selects “Play” and the video begins to play on the user’s mobile.</p> <p>6: After the video plays, the user selects “Comment” in order to write a comment about the video.</p> <p>7: The user types in his/her comment and chooses “Enter”</p> <p>8: The comment is saved and attached to the video.</p> <p>9. The video resumes playing.</p>
Extensions	<p>1a: The user decides to cancel the addition of a comment.</p> <p>1a1: The user selects “Cancel”</p> <p>1a2: The comment is cancelled.</p> <p>1b: After submitting his/her comment, the user decides to delete it.</p> <p>1b1: The user sees the list of comments associated with the video.</p> <p>1b2: The user selects the “X” to delete their comment.</p> <p>1b3: The user is asked if he or she would like to delete the comment.</p> <p>1b4: The user selects “Yes” and the comment is deleted.</p> <p>1b5: If the user selects “No”, he/she is returned to the list of the comments associated with the video.</p>

Adding a new group or a space	
Actor	Any

Preconditions	The user has a working internet connection and has successfully logged in to the application.
Trigger	The user decided to add a new group or space under his/her login name.
Step sequence	1: The user has successfully logged in to P2P-FUSION Mobile. 2: The user sees a list of groups that he/she belongs to. 3: The user chooses “Add group” from the list. 4: The user is asked to enter a name for the group and press “Enter”. 5: The user is asked to select a default icon for the group and press enter. 6: The user is informed that the group has been created and is returned to the main group page. Invitation codes are sent out via SMS.
Extensions	1a: The user decides to cancel the creation of a new group midway through the process. 1a1: The user selects “Cancel” 1a2: The user is returned to the main group page.

Adding a new video	
Actor	Any
Preconditions	The user has a working internet connection and has successfully logged in to the application.
Trigger	The user decided to add a new video under his/her login name.
Step sequence	1: The user has successfully logged in to P2P-FUSION Mobile. 2: The user sees a list of groups that he/she belongs to. The user enters

	<p>the group. The user sees the list of the content.</p> <p>3: The user chooses “Add video” from the list.</p> <p>4: The user is asked to enter a name for the video and press “Enter”.</p> <p>5: The user is asked to select a default icon for the video and press enter.</p> <p>6: The user is informed that the video has been. The user is asked if he or she wants to send out an SMS notification.</p> <p>7: The user selects “Yes” and a list of names comes up. The user marks which names should receive the SMS. The SMS is sent.</p>
Extensions	<p>1a: The user decides to cancel the addition of a new video midway through the process.</p> <p>1a1: The user selects “Exit”</p> <p>1a2: The user is returned to the main group page.</p>

Message or Notification that a comment has been added	
Actor	Any
Preconditions	The user has a working internet connection and has successfully logged in to the application.
Trigger	The user has agreed to receive messages when a new video is added or commented on in a group of which he or she is a member.
Step sequence	<p>1: The user has successfully logged in to P2P-FUSION Mobile.</p> <p>2: The user is sent a SMS message with a link that X video has been uploaded or that X video has been commented on.</p> <p>3: The user clicks on the message link and is taken to the video.</p> <p>4: The user views the video.</p>
Extensions	<p>1a: The user decides to ignore the message by choosing “Ignore”.</p>

6.7 Testing Session Material

6.7.1 Scenarios

The Cooking Community Scenario

Below is the original scenario which inspired this thesis and was published in the “P2P-FUSION Description of Work”.

“My mother has promised me that she will teach me how to make the Carelian Stew the right way. She will make a cooking video for me, explaining how she and her mother have always made this dish.

She begins by making an inventory of what she needs so that things would be easy to reach and she would not have to do a lot of editing later. She is quite experienced with making these videos, she has already made several ones for the family cooking library, so she knows how to save her own troubles by preparing just a little.

She begins by recording on video on her mobile phone (with fairly high quality video) her narrative overview of how the food is prepared, and what ingredients are needed. While narrating, she realizes that she should actually show how to select the meat in the store, and decides to shoot that part on video later and mix it in.

Then she proceeds to prepare the food and places the phone-camera on a spot in her kitchen that she has cleared for this purpose. Once in a while she brings the camera down to take close-ups of the various ingredients and work phases. She “edits while she shoots” so that she does not get a lot of extra footage.

However, in the end the raw material she shot still requires some editing to become a program that is enjoyable and informative. But most of this editing is simply removing unwanted fragments. She also makes little marks at points where the video shows the basic ingredients and adds the ingredient information as metadata, so that these can be displayed in a shopping list helper. She also makes a trailer that advertises the video – a short narrative overlaid on top of a few of the best visuals from the video.

After the rough editing, she is happy to publish the video for her family. In her cameraphone recording software, she saves the video with certain preset access rights (and at the same time, default licensing options) that restrict access to only her immediate family.

As she saves the video, the publishing system takes it forward, following the access restrictions she has given. It gets archived in her own system and distributed to the family members through the Peer-to-peer Network. To the various family members, it becomes visible in their Personal Mediascape according to each one's personal configuration.

As a keen cook, I have set my configuration so that whenever my mother is kind enough to make a video, it is a high priority event for me. I know she wants to hear comments immediately, so I receive the video as a Novelty Item on my Personal Priority Channel. This is a selection of audiovisual input that contains materials specially recommended to me by my friends and family.

On my way home, sitting on the bus, I begin to view the trailer of the video on my mobile handset. I give immediate feedback – a small annotation that says thank you to my mother – this food is one of my favorites. I decide to make the dish today. At home the video is waiting on my TV system, and I turn it on. While I am cooking, I navigate the video with my handset as a remote control. The structure of the program with metadata describing the content is visible on the remote, so it is easy to navigate to the part I need to see.

I think this is one of her best videos – also because the dish is so delicious. I ask her for permission to make it public for our Cooking Community. We have quite an avid community of family cooks among our friends. We have chosen to keep this community and its videos public and openly available to anyone. Through friend-to-friend connections, the Cooking Community has grown to cover lots of different cooking genres and even continents.

I have several friends abroad whom I know would like this style of food. My mother has already agreed in her access rights assignment that I have the right to use her video in my own compilations, and that it should then move on with a Creative Commons license.

I make a new version of the video with English subtitles, and some slightly embarrassing family stories taken out. As my mother did not have time to make the meat selection part, I go and add that. Finally I publish the video into the Network.

In a week, we receive a lot of feedback – several Success Reports with nice images of the results, as well as links to other videos that tell about related dishes from other cultures. I have set my preferences so that I receive these on my Personal Priority Channel, because they are direct responses to material I published.”

The Parkour Community Scenario

Participants

Parkour, roughly translated into English, means “the art of movement”. It was developed in France during the early part of the 20th century by a French former naval officer and, while difficult to categorize, can somewhat be related to martial arts. The goal of Parkour is to gracefully overcome all obstacles in one's path with an emphasis on speed, efficiency, and agility. While there is no age limit to participate, many current practitioners of Parkour are teenage or adult males.

In this scenario, a group of Parkour enthusiasts has gathered for a “jam”. In the context of a community that practices Parkour, a jam is an event where members of the group get together to work on training and developing their skills. Since it is during the week, only half of the usual crew is able to make it due to other commitments (family, work, etc). However, since they are all close friends and enjoy practicing together, even those who are not able to attend would like to be kept up to date by watching videos of the event. As the jam begins, it is decided that one member will film the participants and the rest will actively participate. The group members take turns filming in order to ensure a fair distribution of practice time and filming time since no one wants to only be behind the camera. Since many participants already have mobile phones with video cameras built-in, this is the camera of choice since they are light to carry and easy to use.

After filming a particularly good short clip, the Parkour enthusiast who has been filming the jam decides to upload it to other members of the group. With the clip already saved to his mobile phone, he opens the P2P-FUSION application and logs in. He then chooses “Parkour” from his list of available groups. Once he has selected his group, he sees a list of files associated with the group. He goes to the option key on the left hand side of his phone and chooses “Upload video”. The application prompts him to choose a file and he chooses the clip he has just filmed and presses “OK”. The video has now been uploaded to the group and is available for all group members to view and comment on.

Non-Participants

Although disappointed that she was not able to actively join, a non-participant of the group is happy that she can view the action remotely. She thinks the video is great and decides to comment on it. By pushing the option key on the left hand side of her phone, she is able to add a comment. “Nice work!” she types and pushes “OK”. The comment is now attached to the video for the rest of the group to see. Realizing that she still has a lot of work to do, she puts down her phone knowing that every time something good is posted, she will be notified immediately.

The Mobile Application Developers Scenario


In this scenario, a community of developers has gathered to share ideas about mobile application development. Currently, they have just completed a week-long intensive developers workshop where they worked in groups together.

Since the workshops are only a week long, it is crucial that they work efficiently for the next workshop. Due to time constraints, they would like to prepare in advance for the next workshop by using P2P-FUSION by filming short clips of new ideas. Each of the videos is under 30 seconds because the idea is to present a simple, brief concept which other members of the group can comment on.

They take turns filming each other and when they have finished a community member uploads the files into P2P-FUSION. After the files have been uploaded, each group member can view the videos and comment on them.

For this community, the added value of using P2P-FUSION for organizing and storing their workshop ideas on mobile devices is that they can have an easily accessible place to comment on each other's work within a private community. Additionally, they do not need to be at their desk when an idea strikes them, they can be on the bus or walking through the forest when they choose to comment if that is where inspiration strikes.

6.7.2 Co-design Session Introduction Presentation



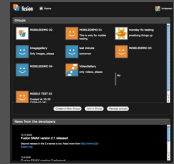
fusion

A Case Study on
Ubiquitous Social Networking:
Fusion Mobile

Brief Overview


- Project description
- Mobile component
- Testing the prototype
 - Methods
 - Outcome

What is P2P Fusion?



- Alike project with EU & other partners
- Creative reuse of audiovisual material
- Collaborate with user communities
- Easy to use peer-to-peer system to share files privately

Why is P2P Fusion Important?

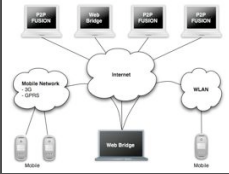


- Publish only to audience you want
 - View, create groups
- Goal is to allow distributing and remixing fragments of audiovisual content
- Supports open content licensing (Creative Commons)
- Identifies intellectual property (IP) issues that are relevant

Mobile Version

- **Intentional limited functionality for mobile**
 - Uploading, viewing, commenting on content
 - View, create groups
 - See what other members are doing, simple chat
- **Capturing the moment**
 - Record video on mobile, upload immediately, comment quickly
 - For more detailed work, desktop version is fully-functioning
 - Private space to use when away from desktop
- **Technology**
 - Multi-layered
 - Python

Visualization of Technology



Testing Methods

- **Free exploration, please try:**
 - creating a group
 - joining a group
 - viewing content
 - commenting on content
 - exploring content from other users

Testing Outcome

- **What we would like to know:**
 - Does the mobile client support community activities?
 - How do you feel about using this type of software in conjunction with a desktop version of Fusion?

Thank You!

- Other comments, suggestions, ideas, critiques

Figure 49 Details of the Co-design Session Introduction